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ABSTRACT

This publication is the teacher's guide for the competency-based Prevocational Manufacturing Exploration curriculum for secondary students in West Virginia. The guide is intended to help instructors give students career exploration activities in the various fields and job categories of manufacturing. The guide is organized into 18 learning modules. In each module is a career information sheet that includes a unit of study, occupational category, occupational division, occupational group, occupational overview, and representative job title within the occupational group. Included within the guide are listings of audiovisual aids, references, equipment, and supplies for presenting the various areas of manufacturing. Also included are the answers to all of the questions from the worksheets contained in most lessons. The following occupations are represented by the learning modules: wrought iron worker, foundry worker, printer, electricity/electronics technician, artist, compositor, photographer, drafter, sheet metal worker, machinist, welder, motor repairer, radio and television repairer, air conditioner mechanic, custodian, coal miner, and warehouse operator. (KC)

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Teacher's Guide
Competency Based Education Curriculum
for

PREVOCATIONAL MANUFACTURING EXPLORATION

Prepared by

William R. Thompson
TAU Associates, Inc.

U.S. DEPARTMENT OF HEALTH,
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This curriculum was developed through the cooperation and support of the Bureau of Vocational, Technical and Adult Education, West Virginia Department of Education, Charleston, West Virginia.

March 1981

CE 028 950

PREFACE

It is with great pleasure that we bring you another West Virginia competency based education (CBE) curriculum. This competency based Prevocational Manufacturing Exploration curriculum was developed under contract for West Virginia. The effort was coordinated by staff of the West Virginia Department of Education, Bureau of Vocational, Technical and Adult Education.

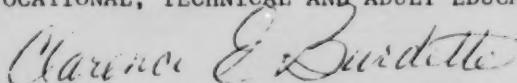
This document is organized into 18 learning modules. Each career information sheet includes a unit of study, DOT occupational category, DOT occupational division, DOT occupational group, occupational overview, and representative job title with DOT codes.

The competency based Prevocational Manufacturing Exploration curriculum was disseminated to West Virginia career education instructors at inservices conducted in the spring and summer of 1981. Additional copies of this curriculum are available from the:

Vocational Curriculum Laboratory
Cedar Lakes Conference Center
Ripley, West Virginia 25271
Toll-free 1-800-642-2670

I trust this material will be of assistance in your program. Any suggestions you may have for improving this curriculum may be sent to our state Curriculum Lab. Through this feedback we plan to continually update and revise our materials.

VOCATIONAL, TECHNICAL AND ADULT EDUCATION



Clarence E. Burdette
Assistant State Superintendent of Schools

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FOREWORD

This teacher's guide was prepared to be used in conjunction with a competency based Prevocational Manufacturing curriculum manual. Included within this guide are listings of audio visual aids, references, equipment and supplies for presenting the various areas of manufacturing. Also included are the answers to all of the questions from the worksheets contained in most lessons.

Instructors are advised that materials found within this guide serve only as minimum necessities and may be substituted for or added to as individual classrooms dictate.

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INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

None

II. BOOKS

- Groneman, Chris H. and Feirer, John L. General Industrial Education. McGraw-Hill Book Company, New York, New York, 1974.
- Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.
- Kagy, Frederick D. Graphic Arts. Goodheart-Willcox Co., Inc., South Holland, Illinois, 1970.
- Little, Richard and Little, Sherry. Metalworking. American Technical Society, Chicago, Illinois, 1979.
- Newkirk, Louis V. General Shop for Everyone. D. C. Heath and Co., Boston, Mass., 1967.
- Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.
- Van Valkenburgh, Nooger and Neville, Inc. Basic Electricity. John F. Rider Publisher, Inc., New York, New York, 1954.
- Williams, Gerald E. Electricity and Electronics. American Technical Society, Chicago, Illinois, 1979.

III. EQUIPMENT AND SUPPLIES

Drafting board	Wrench	Riser cutter
T-square	Ball pein hammer	Trowel
30/60° triangle	Hand drill	Spoon
45° triangle	Electric drill	Lifter
Architect's scale	Drill press	Strike-off bar
Eraser	Drill bits	Bellows
Erasing shield	Center punch	Parting compound
Drafting set	Rivets	Bottom board
Steel rule	Rivet set	Turn-over board
Combination square	Riveting block	Draw pins
Scribe	Foundry pattern	Bulb sponge
Wrought iron	Sand	Vent wire
Bench vise	Flask	Molding bench
Bending forks	Hand rammer	Crucible furnace
Bending jig	Riddle	Crucible
Universal bender	Sprue cutter	Aluminum
Pyrometer	Crucible tong	Carrying shank
Asbestos clothing	Ingot mold	Ladle
Carbon paper	Linoleum block	Masking tape
Bench hook	Proof Press	Linoleum carving tools
Brayer	Ink, press	Paper
Glass plate	Type wash	Rags

Silk screen stencil material		X-acto knife
Lacquer thinner	Silk screen frame	Spatula
Ink, silk screen	Magnets	Iron filings
Batteries	Wire, insulated	Wire nuts
Needle nose pliers	Wire stripper	Wire cutter
Electricians tape	Soldering iron	Solder
Asbestos board	Light bulbs	Bulb sockets
AC power cord		

1. The major types of magnets are:

The three major types of magnets are the natural magnet, the permanent magnet and the electromagnet.

2. Three principles of magnetism are:

Some principles of magnetism are:

- A. magnets attract iron*
- B. iron and steel can be magnetized*
- C. All magnets have a north and a south pole*
- D. Like poles repel, opposites attract*
- E. All magnets have a magnetic field*

3. Answer these questions:

- A. What is magnetism?

Magnetism is a force that causes some materials to be attracted or repelled by other materials.

- B. How do you make an electromagnet?

To make an electromagnet, wind a wire around an iron core (nail, bolt, etc.) and attach the contacts of a battery across the coil.

- C. What happens to the magnetic field if we break a magnet into two pieces?

When a magnet is broken into two pieces, both pieces will exhibit magnetic characteristics and have a magnetic field.

- D. What is a lodestone?

A lodestone is a natural magnet in a form of iron ore.

- E. What is a temporary magnet? A permanent magnet?

A temporary magnet is a magnet that loses its magnetism (after the current is shut off)

A permanent magnet, like a horseshoe magnet, retains its magnetism for a long period of time.

WORKSHEET

4

1. The different types of batteries and their uses are:

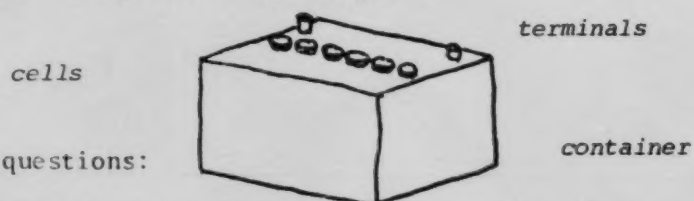
A. *Primary Cell is a flashlight battery*

B. *Secondary Cell is a car battery*

2. Draw a dry cell and label its parts.



3. Draw a storage battery and label its parts.



4. Answer these questions:

A. What kind of electrical current is produced by a battery?

Batteries produce direct current (DC).

B. What is a primary cell? A secondary cell?

A primary cell is one in which the cell material is used up. A secondary cell is one which can be recharged.

C. Why are there two terminals on a battery?

Two terminals are found on a battery to allow a positive pole and a negative pole.

D. How many cells does a 12 volt car battery have?

A 12 volt car battery has 6 cells, each producing 2 volts.

1. The three elements of electricity are:

The three elements of electricity are current, voltage and resistance.

2. Definitions:

Ohm - the unit of resistance

Ampere - the unit of electrical current

Volt - the unit of voltage

3. Ohm's Law is:

One volt will push one ampere of current through one ohm of resistance. Voltage equals current multiplied by resistance. $E = IR$

4. Answer these questions:

- A. Using Ohm's Law, tell how many volts will an appliance need if it has 7 ohms and 2 amps.

14 volts

- B. How many amps will an appliance draw if it has 10 volts and 5 ohms?

2 amps

- C. How many ohms will an appliance have if it has 100 volts and 3 amps.

33.3 ohms

LAYOUT AND DESIGN ARTIST

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

None

II. BOOKS

- Bently, R. G. et.al. Graphic Communication Series: A.B. Dick Company, 1970.
- Carlsen, Darvey E. Graphic Arts. Peoria: Chas. A. Bennett Co., Inc., 1970.
- Cleeton, Glen U., Cornwall, Raymond L. and Pitkin, Charles W. General Printing. Bloomington: McKnight & McKnight Publishing Company, 1963.
- Kagy, Frederick D. Graphic Arts. South Holland: The Goodheart-Willcox Co., Inc., 1970.
- Printing Layout and Design. Albany & Delmar Publishers, Inc., 1968.

III. EQUIPMENT AND SUPPLIES

Assortment of cold type fonts
Drafting boards
T-squares
30/60° triangles
45° triangles
Architects scale
Ink
Speedball pen and quills, assorted

1. Identify the following styles of type:

STYLE

a. Gothic

Style

b. Script

STYLE

c. Roman

2. Identify the following families of type.

FAMILY

a. Italic

FAMILY

b. Bold

FAMILY

c. Light

FAMILY

d. Extended

FAMILY

e. Condensed

3. Describe a feminine type style and a masculine type style and tell where they would be found.

A feminine type style is a light, script style and would be used in the layout of women's products, elegant furnishings, fine china, etc. A masculine type style is bold and gothic and is used in the layout of men's products, steel companies, trucking firms, etc.

GRAPHIC ARTS COMPOSITOR

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

Type Right, Teaching Aids Exchanges, Inc.

II. BOOKS

Bently, R.G., et.al. Graphic Communication Series. A.B. Dick Company, 1970.

Broekhuizen, Richard J. Graphic Communications. Bloomington: McKnight & McKnight Publishing Company, 1973.

Carlsen, Darvey E. Graphic Arts. Peoria: Chas. A. Bennett Co., Inc., 1970.

Cleeton, Glen U. Cornwall, Raymond L. and Pitkin, Charles W. General Printing. Bloomington: McKnight & McKnight Publishing Co., 1963.

Kagy, Frederick D. Graphic Arts. South Holland: The Goodheart-Willcox Co., Inc., 1970.

Swerdlow, Robert M. Graphic Arts. Chicago: American Technical Society, 1979.

III. EQUIPMENT AND SUPPLIES

Cold type font

California job case

Composing stick

Type form

Galley

Proof press

Typewriter

Handliner

Hand lettering aids assortment

Line gage

String

Ink

Proof press

Brayer

Type cleaner

Rags

Typing paper

Ink eraser

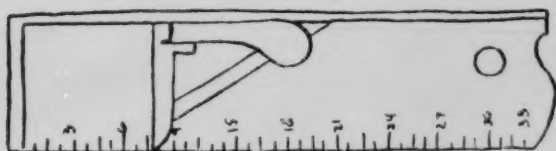
Clip art

Rubber Cement

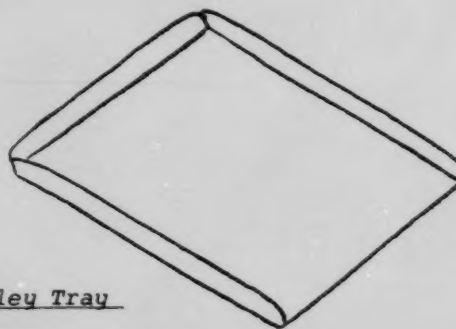
1. Explain how to set type in a composing stick.

To set type in a composing stick, first set the stick to the required line length and insert a slug. Next, select the letters desired with your right hand as you hold the stick in your left hand. Place the letters in the stick with the nicks up. Start at the left and work to the right.

2. Identify this equipment:



a. Composing Stick



b. Galley Tray

3. Define the following terms:

Flush Left - When all of the lines of type are aligned with the left hand margin and are ragged on the right.
Flush Right - When all of the lines of type are aligned with the right hand margin and are ragged on the left.
Centered - When all the lines of type are ragged left and right but have a common center line.
Justified - When all the lines of type are spaced to fill out the full measure of the line. All lines begin at the left margin and end at the right margin.

4. TRUE or FALSE. Always begin hand-setting type by first inserting a lead into the composing stick.

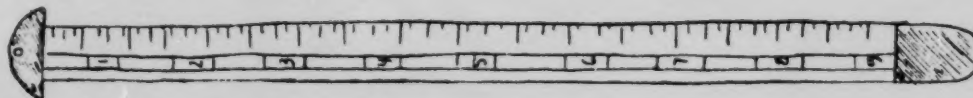
WORKSHEET

1. Show where hand set type is stored by filling in the following California type case:

		5	4	,	k		1	2	3	4	5	6	7	8	\$	-					
		em	em	-																	
j														9							
b		c		d	e		i		s		f	g			A	B	C	D	E	F	G
?														0							
:	l		m		n	h							en	em							
							o	y	p	w	,	q.	q.		H	I	K	L	M	N	O
z																					
x					3																
	v		u		em		a		r		i	:	2	3	P	Q	R	S	T	V	W
q													em	em							
													q.	q.	X	Y	Z	J	U	&	

2. Identify this tool:

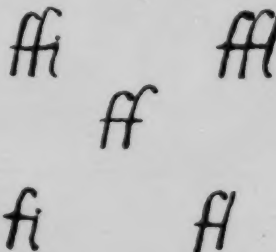
Line Gauge



3. What are these characters called? What are they used for?

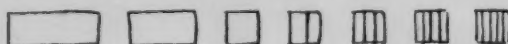
Ligatures

Ligatures are used wherever letters in a word are arranged in this order.



4. Identify the following spaces and quads:

- a.
- 3-EM Quad



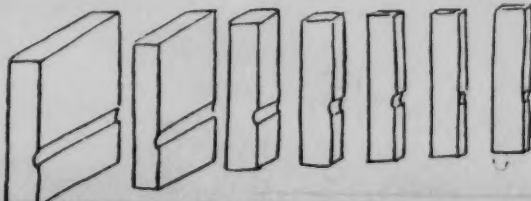
- e. 3-EM Space

- b. 2-EM Quad

- a. b. c. d. e. f. g.

- ### f. 4-EM Space

- C. EM Quad



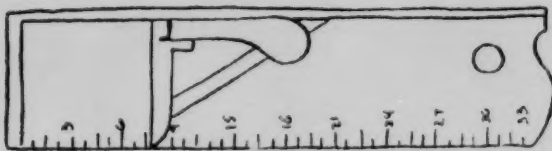
- g.
- 5-EM Space

- d. EN Quad

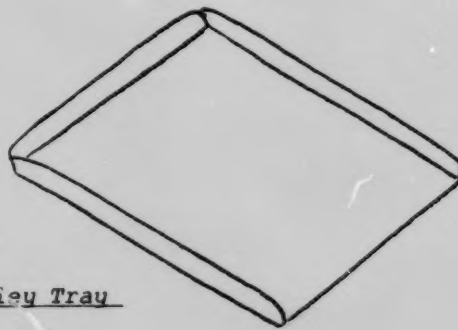
1. Explain how to set type in a composing stick.

To set type in a composing stick, first set the stick to the required line length and insert a slug. Next, select the letters desired with your right hand as you hold the stick in your left hand. Place the letters in the stick with the nicks up. Start at the left and work to the right.

2. Identify this equipment:



a. Composing Stick



b. Galley Tray

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Flush Left - When all of the lines of type are aligned with the left hand margin and are ragged on the right.

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Centered - When all the lines of type are ragged left and right but have a common center line.

Justified - When all the lines of type are spaced to fill out the full measure of the line. All lines begin at the left margin and end at the right margin.

4. TRUE or FALSE. Always begin hand-setting type by first inserting a lead into the composing stick.

WORKSHEET

1. Identify this piece of equipment: *Typewriter*



2. Explain how to compose justified copy on the typewriter.

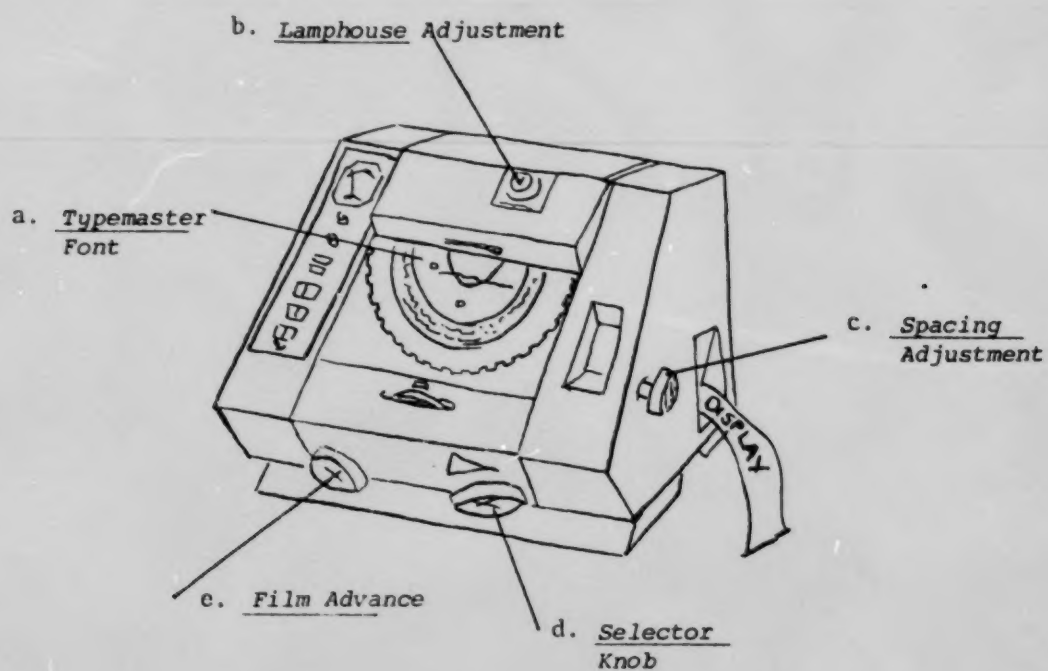
Justified copy is set on the typewriter by typing two copies of the desired text material. First, a line is typed and the number of spaces noted to provide justification. Then, the same line is typed in final form complete with justification spacing.

3. How does the IBM Selectric typewriter differ from a normal one?

The IBM Selectric typewriter differs from a normal typewriter in that it is equipped with interchangeable fonts of type. It also employs a moveable type font rather than a moveable carriage.

WORKSHEET

1. Name the parts of the Headliner:



2. TRUE or FALSE. The headliner is a photo-composition machine.

WORKSHEET

1. Tell how the Intertype Fotosetter operates.

The Intertype Fotosetter is a keyboard operated letter-by-letter phototypesetting machine. As the operator selects a character, a fotomat(matrix) drops by gravity onto a belt for assembly. The lines of matrices are justified, exposed and redistributed automatically.

2. Tell how the CRT Phototypesetter - Linotron 505 operates.

The Linotron 505 is a letter-by-letter cathode ray tube (CRT) phototypesetting system. Type characters can be selected by keyboard, computer input or teletype. A control unit receives the input and coordinates instructions for the reproducing unit. The reproducer projects all the copy onto a CRT system before it is finally printed.

3. Tell how the Harris 1500 operates.

The Harris 1500 utilizes a video typewriter which allows the operator instant feedback to copy setting. Any corrections can be made immediately on the video screen. This information can be printed or stored for review at a later time.

GRAPHIC ARTS PHOTOGRAPHER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

Halftones and Other Tones, Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650.

High Contrast Photography for Instruction, Indiana University, Audio-Visual Center, Bloomington, Ind. 47401.

Line Photography, Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650.

II. BOOKS

Basic Photography for the Graphic Arts. Rochester: Eastman Kodak Company, 1972.

Bentley, R.G. et.al. Graphic Communication Series. A.B. Dick Company, 1970.

Broekhuizen, Richard J. Graphic Communications. Bloomington: McKnight & McKnight Publishing Company, 1973.

Carlsen, Darvey E. Graphic Arts. Peoria: Chas. A. Bennett Co., Inc., 1970.

Cappali, John E. Photo-offset Fundamentals. Bloomington: McKnight Publishing Company, 1973.

LaGuer, Marshall and Lathrop, Irvin. Photography. Chicago: American Technical Society, 1979.

Pocket Pal. New York: International Paper Company, 1970.

III. EQUIPMENT AND SUPPLIES

Process camera

Magnifying glass

Contact printer

Filters

High contrast film

Safelight

Film processing chemicals

Trays

Timer

Graduate

Proportion scale

Halftone screen

Film and filter tables

Goldenrod paper

Litho tape

Opaque

Opaque brush

Stripping knife

WORKSHEET

1. Identify the following forms of copy:



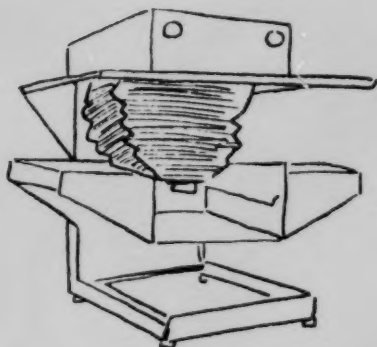
a. Halftone

b. Line

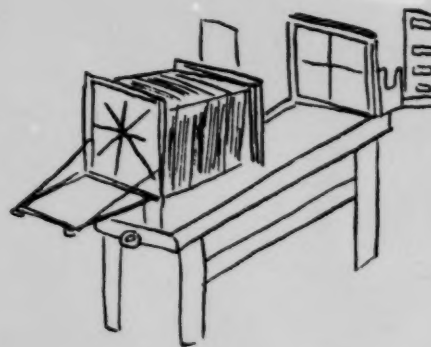
c. Line

d. Halftone

2. Identify the following types of process cameras:



a. Vertical



b. Horizontal

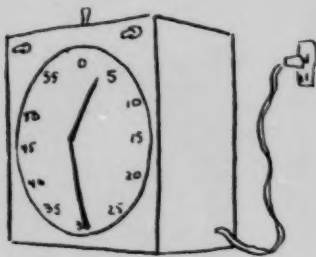
3. Define "high contrast film."

High contrast means that all areas of a negative are either black (opaque) or clear. No gray tones exist.

4. TRUE or FALSE. The emulsion is the light-sensitive part of graphic arts film.

WORKSHEET

1. Identify the following equipment:



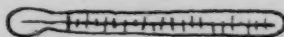
a. Timer



b. Gray Scale



d. Trays



c. Thermometer



e. Safelight

2. Name the three chemicals used in processing graphic arts film.

- A. *Developer*
- B. *Stop Bath*
- C. *Fixer*

3. TRUE or FALSE. A yellow safelight is used while processing graphic arts film.

4. TRUE or FALSE. The developer will clear all of the milky look in graphic arts film.

PRINTER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

Lithography or Offset Printing, Graphic Arts Films, Inc., P.O. Box 176, Glenville Station, Greenwich, Ct. 06830.

Paper Making, Northwest Pulp and Paper Association, Rarig Film Services, 834 Industry Drive, Seattle, Wash. 98188.

Printing - Platen Press Makeready, University of Wisconsin-Stout, Audio Visual Center, Menomonie, Wisc. 54751.

II. BOOKS

Bently, R. G., et.al. Graphic Communication Series. A. B. Dick Company, 1970.

Broekhuizen, Richard J. Graphic Communications. Bloomington: McKnight & McKnight Publishing Company, 1973.

Carlsen, Darvey E. Graphic Arts. Peoria: Chas. A. Bennett Co., Inc., 1970.

Cogoli, John E. Photo-Offset Fundamentals. Bloomington: McKnight Publishing Company, 1973.

Shapiro, Charles. The Lithographers Manual. Pittsburgh: The Graphic Arts Technical Foundation, 1968.

Swerdlow, Robert M. Graphic Arts. Chicago: American Technical Society, 1979.

III. EQUIPMENT AND SUPPLIES

Platen printing press

Pilot press

Typewriter

Platemaker

Offset press

Chases, assorted

Furniture, wood

Guoins

Guoin key

Planer

Reglets

Ink

Paper

Paper cutter

Spatula

Starch

Tympan sheet

Press board

Gauge pins

Type cleaner

Rags

Rubber stamp press

Stamp press chase

Metal furniture

Matrix board

Screwdriver

Tray

Stamp, rubber

Wood handle

Rubber cement

Direct image plates

Tissue paper

Grease pencil

Fountain solution

High contrast film

Plate desensitizer

Lacquer, plate

Gum arabic

Cotton pad

Pre-sensitized plates

Pail

Mold

Deckle

Egg beater

Rolling pin

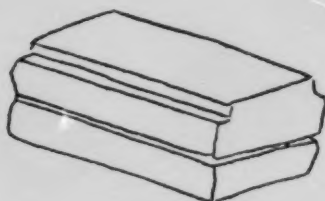
Electric iron

Blotting paper

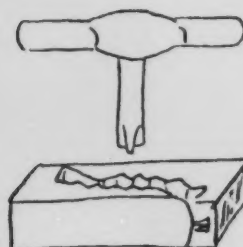
Paper making kit (pail, mold, iron, etc.)

WORKSHEET

1. Identify these tools:

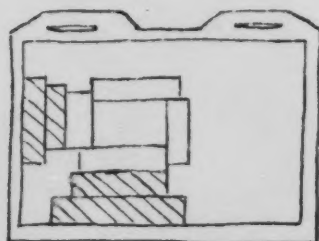


a. Planer



b. Quoin and Key

2. In the following illustration, what lock-up method is shown?



Chaser

3. Describe how to plane a type form and check for lift.

To plane and check a type form, place it on the imposing stone, loosen the quoins and lay the planer on the form. Gently rap the planer with the head of the key. Tighten the quoins and elevate the type form. With finger pressure, push against the letters to see if they move. (They shouldn't.)

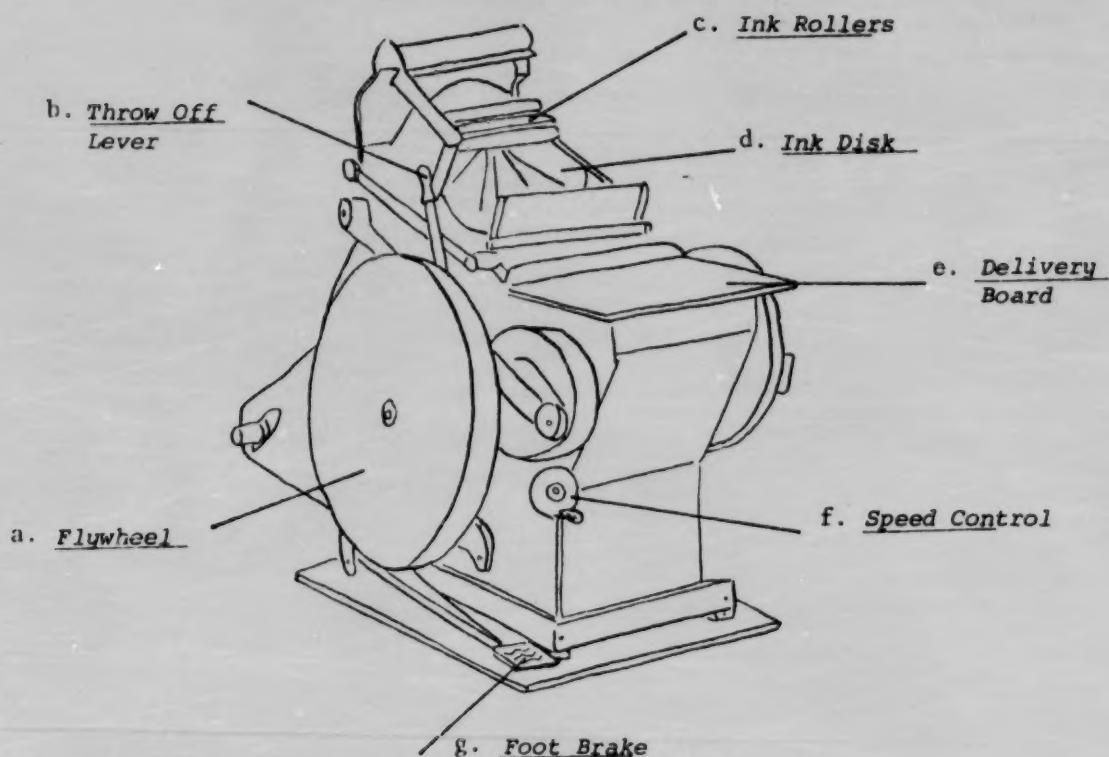
WORKSHEET

1. Identify the three types of letterpress.

The three types of letterpresses are:

- A. Platen
- B. Cylinder
- C. Rotary

2. Name the parts of the following platen press:



3. List the steps (in order) for setting-up a platen press for printing.

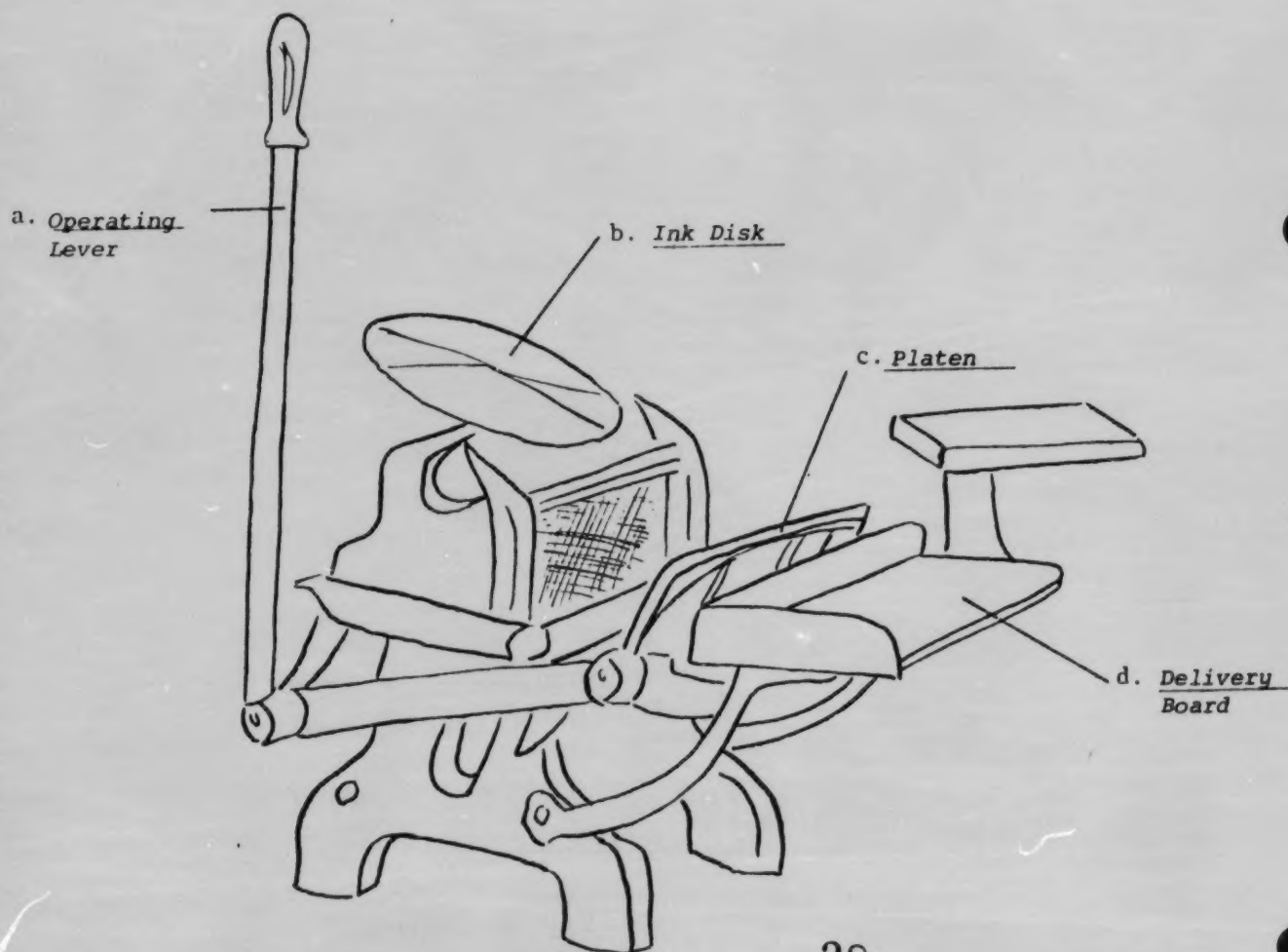
- A. Ink the press.
- B. Dress the press.
- C. Install the chase.
- D. Adjust the grippers.
- E. Ink the type form.
- F. Set the gauge pins.

WORKSHEET

1. Compare the set-up and operation of the pilot press with that of the platen press.

The set-up of the pilot press is identical to that of the platen press. Their operations vary only in the power required to cycle the press.

2. Name the parts of the following pilot press:



WORKSHEET

1. Identify the four main steps in rubber stamp making.

The four main steps in making a rubber stamp are:

- A. Prepare the type form.*
- B. Make the matrix.*
- C. Form the rubber.*
- D. Mount the stamp.*

2. Compare chase lock-up for rubber stamp making with chase lock-up for platen press printing.

The chase lock-up for rubber stamp making and platen press printing are identical.

3. Out line the preparation of the matrix and the rubber stamp.

- A. Insert chase and matrix board into press.*
- B. Apply pressure and heat till soft.*
- C. Raise platen and heat 10 minutes.*
- D. Remove and cool.*
- E. Prepare stamp rubber.*
- F. Insert matrix and rubber into press.*
- G. Raise platen and heat six (6) minutes.*
- H. Remove and cool.*

4. TRUE or FALSE. The rubber stamp must be wrong reading for it to print correctly.

5. MULTIPLE CHOICE. To prevent the stamp rubber from sticking to the matrix, always (a) dust the rubber with soapstone (b) heat the press to 500°F (c) use wooden type to make the matrix (d) cover the matrix with heavy plastic.

WORKSHEET

1. Tell How a lithographic plate works.

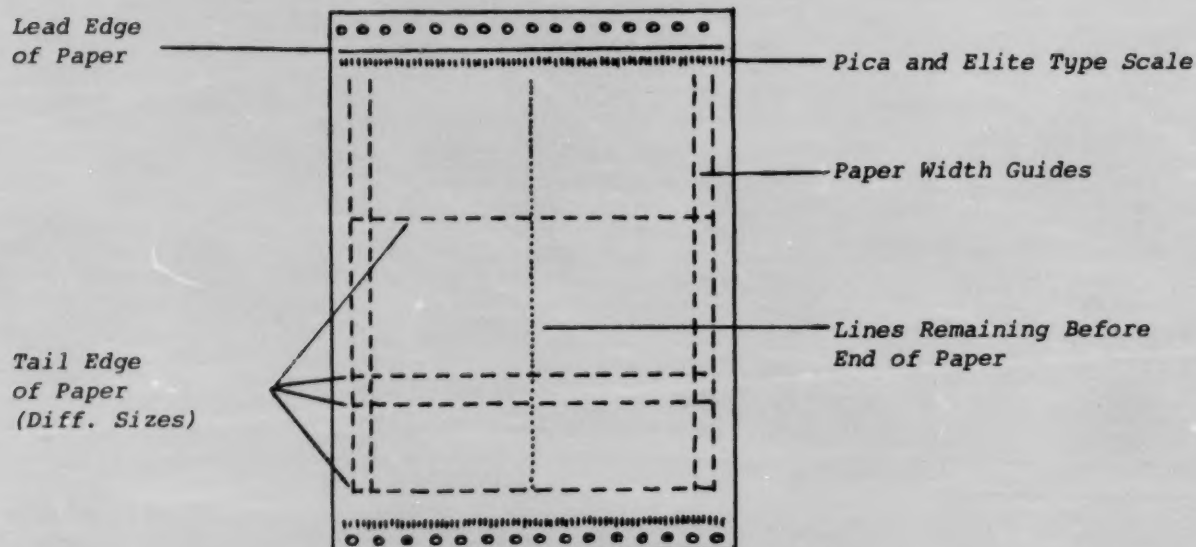
A lithographic plate is grease receptive and water repellent. It attracts oil-based inks and repels water-based fountain solution in the image area. The non-image area is water receptive and grease repellent.

2. List the three types of lithographic plates.

The three types of lithographic plates are:

- A. Direct-Image*
- B. Diffusion-Transfer*
- C. Presensitized*

3. Sketch a direct image plate and identify the guidelines.



WORKSHEET

1. Identify the following piece of equipment:



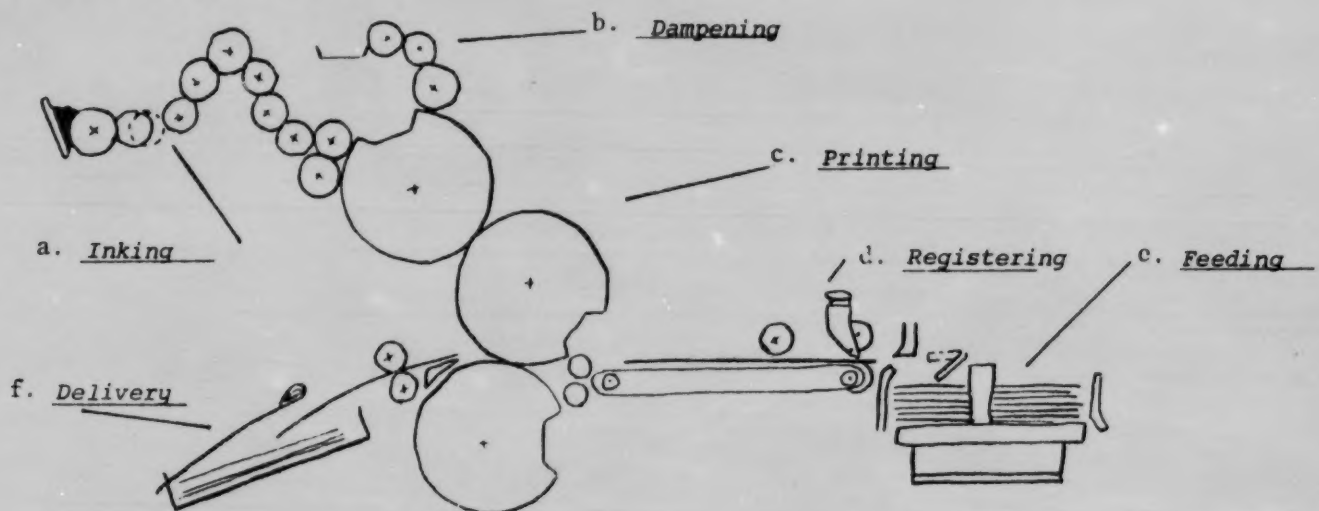
Platemaker

2. Outline the steps in the preparation of a presensitized plate.

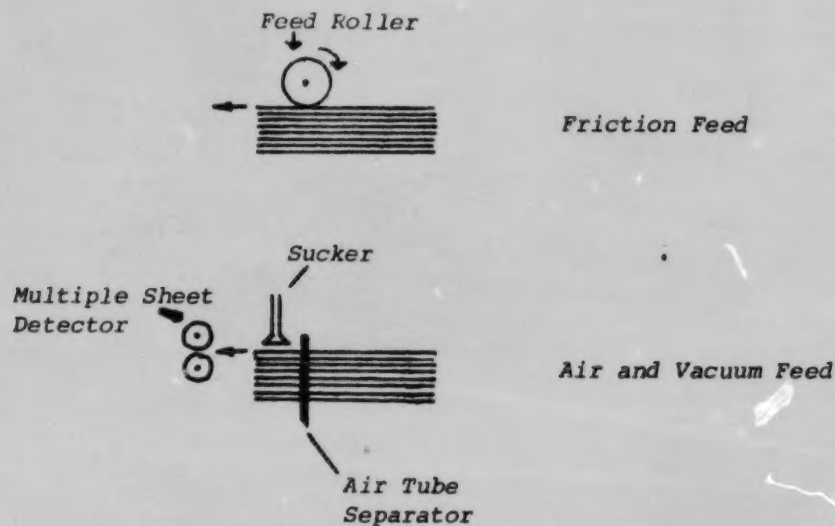
- A. Prepare high contrast negative of copy.
- B. Attach negative to goldenrod.
- C. Cut windows in goldenrod and opaque negative.
- D. Place the flat and presensitized plate in platemaker.
- E. Expose plate.
- F. Process plate.

WORKSHEET

1. Identify the six main systems on the following sketch of an offset lithographic press.



2. Prepare simple diagrams to show "friction" and "air and vacuum" feeding techniques used on offset lithographic presses.



3. TRUE or FALSE. Lithographic ink should be greasy and must not dissolve in fountain solution.

WORKSHEET

1. Tell the uses of the following kinds of paper:

Bond: *Stationary, Business Forms*

Duplicator: *Spirit Duplicated Materials*

Mimeo: *Mimeographed Materials*

Bristol: *Index Cards, Postcards, Tickets*

Newsprint: *Newspapers*

2. Tell what a fourdrinier machine is.

The fourdrinier machine is a constantly moving screen where a paper pulp slurry is deposited and paper is formed.

3. Define ream.

A ream of paper is 500 sheets.

4. Describe how paper is made by hand.

- A. *Fill a tub with water.*
- B. *Add shredded paper tissue.*
- C. *Beat until free of lumps.*
- D. *Insert deckle and mold.*
- E. *Remove deckle and mold with paper.*
- F. *Dry.*

COMMERCIAL PHOTOGRAPHER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- Basic Picture-Taking Techniques, Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650.
- Basic Portraiture Lighting, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Camera, Iwanami Productions, Inc., 22-2 Kanda Misakicho, Chiyoda-Ku, Tokyo, Japan.
- Composition for Photography, Iowa State University, Film Production Unit, Alice Norton House, Ames, Iowa, 50010.
- Controlled Photographic Lighting, Indiana University, Audio-Visual Center, Bloomington, Ind. 47401.
- Darkroom Techniques, University of Minnesota, Audio-Visual Library Service, 3300 University Ave. SE, Minneapolis, Mn. 55414.
- Developing the Negative, U.S. Navy Dept., Office of Information, The Pentagon, Washington, D.C. 20350.
- Exposure Meter - Theory and Use, Iowa State University, Film Production Unit, Alice Norton House, Ames, Iowa 50010.
- Film - How It Works, Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650.
- Light - Sensitive Materials, U.S. Navy Dept., Office of Information, The Pentagon, Washington, D.C. 20350.
- Photography - Anatomy of Camera and Film, Chas. Cahill and Associates, Inc., P.O. Box 1010, Hollywood, Calif. 90028.
- Pinhole Camera, Iowa State University, Film Production Unit, Alice Norton House, Ames, Iowa 50010.
- Printing the Positive, U.S. Navy Dept., Office of Information, The Pentagon, Washington, D.C. 20350.

II. BOOKS

- Basic Photography for the Graphic Arts. Rochester: Eastman Kodak Company, 1972.
- LaCour, Marshall and Lathrop, Irvin. Photography. Chicago: American Technical Society, 1979.
- Pocket Pal. New York: International Paper Company, 1970.

III. EQUIPMENT AND SUPPLIES

X-Acto knife	Easel	Thermometer
Hammer - ball pein	Aluminum foil	Enlarging paper
Exposure meter	Black paint	Glass sheet
Tripod	Electricians tape	Portrait backdrop
Developing tank	Instamatic camera	Flash
Developing trays	35mm camera	Black and white film
Enlarger	Processing chemicals	Photographic studio
Timer	Graduates	lighting kit

WORKSHEET

1. Name the parts of the pin-hole camera.

a. film
holder

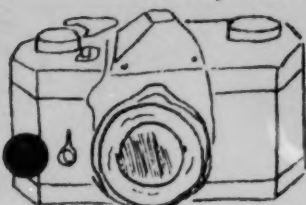


b. aperture

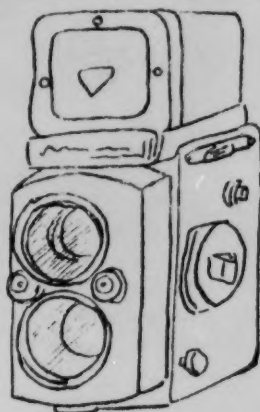
c. shutter

d. box

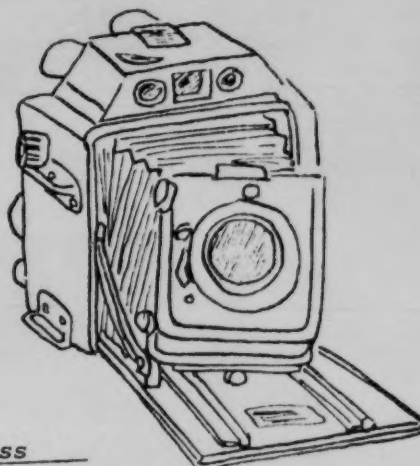
2. Identify the following types of cameras:



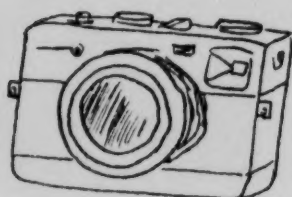
a. SLR



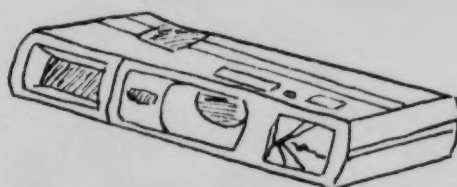
b. TLR



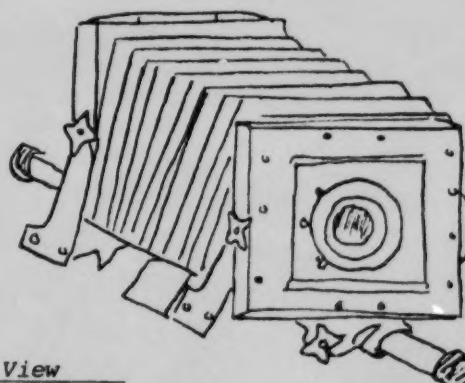
c. Press



d. Rangefinder



e. Box



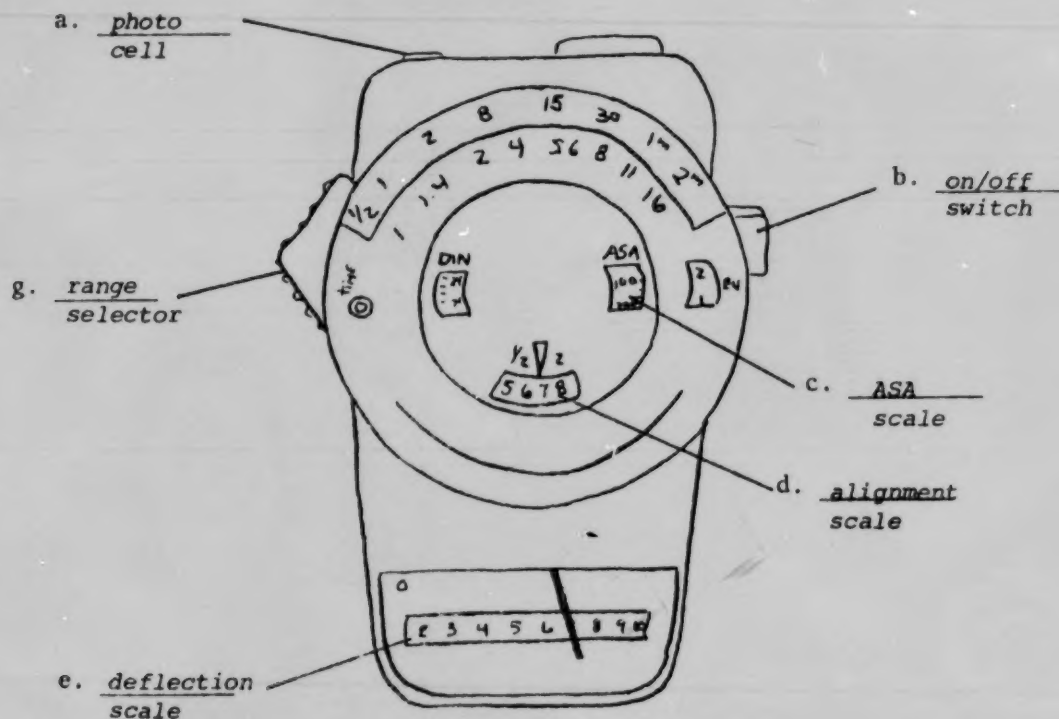
f. View

3. List the shutter speeds and aperture settings on the average camera.

Aperture	1.4	2	2.8	4	5.6	8	11	16	22
Shutter Speeds	1	1/2	1/4	1/8	1/15	1/30	1/60	1/125	1/250
									1/500

WORKSHEET

1. Identify the parts of the following exposure meter:



2. Look at the above exposure meter and answer the following questions:

- a. What ASA value has been set? ASA 125
- b. What aperture should be used if the shutter speed is 1/30 sec?
f8
- c. Was this exposure reading taken indoors or outdoors? indoors

3. Tell three things to consider when composing a photograph.

Things to consider when composing a photograph include:

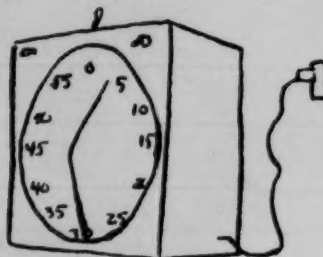
- | | |
|------------------------------|------------------|
| A. subject | E. framing |
| B. foreground and background | F. leading lines |
| C. subject placement | G. lighting |
| D. mergers | H. etc. |

WORKSHEET

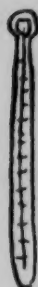
1. Identify the following equipment:



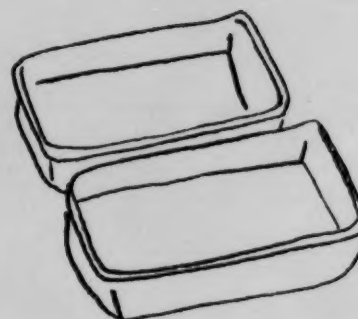
a. safe light



b. timer



c. thermometer



d. trays

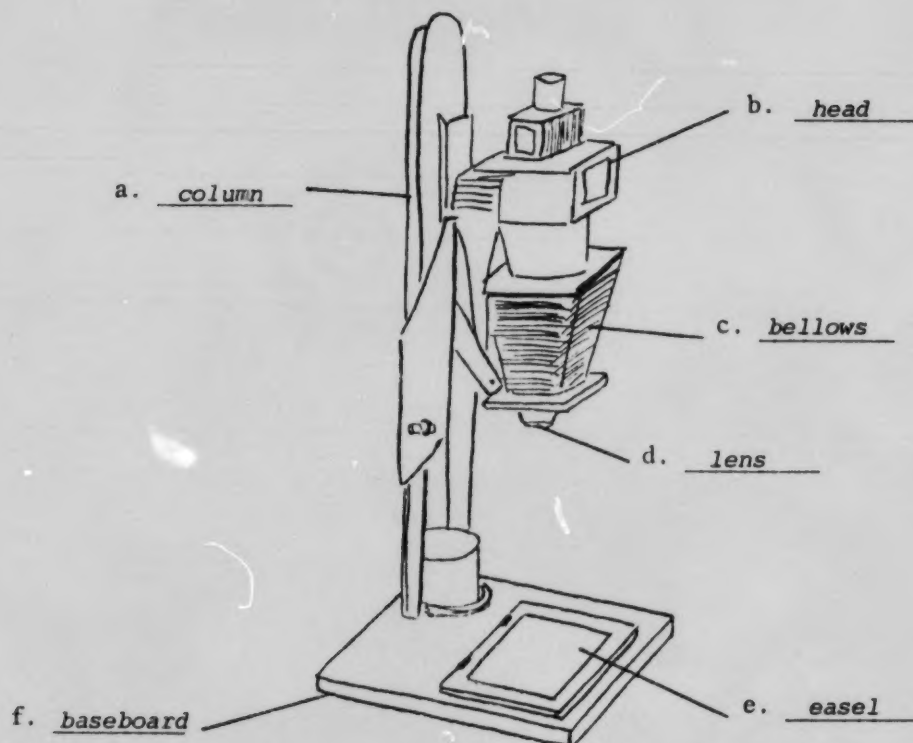
2. Outline the steps in exposing contact prints.

1. Set the enlarger head at its highest point.
2. Set aperture f8.
3. Place photo paper on baseboard.
4. Place negatives in position.
5. Cover with sheet of glass.
6. Expose.

3. MULTIPLE CHOICE. The name of the developer for making contact prints is
 (a) stop bath (b) microdol (c) dektol (d) water wash

WORKSHEET

1. Identify the parts of the following enlarger:



2. Outline how to make a test strip.

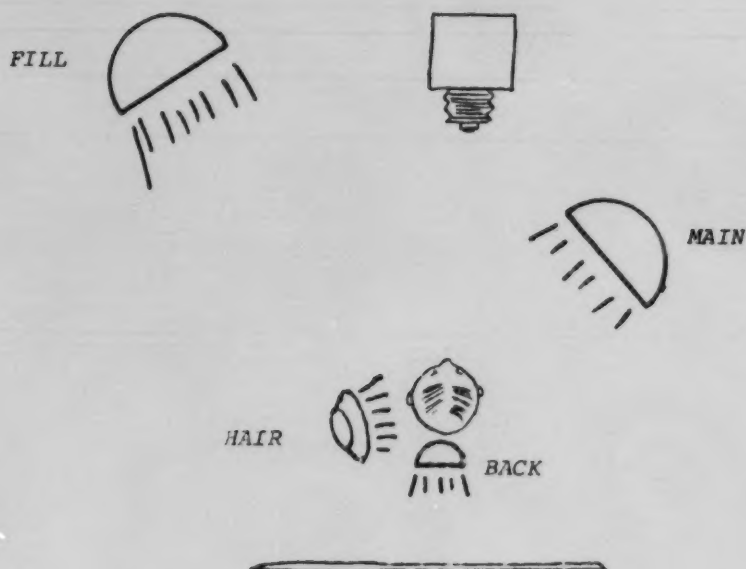
- A. Set timer to 25 seconds.
- B. Cover 4/5 of photo paper with opaque sheet.
- C. Turn enlarger on.
- D. After 5 seconds, quickly move opaque sheet to allow another 1/5 of print to expose.
- E. Do this three more times.
- F. Test strip will be exposed 5, 10, 15, 20 and 25 seconds.

3. TRUE or FALSE. The longer you develop an enlarged print the darker it gets.

4. TRUE or FALSE. Raising and lowering the enlarger head brings the image into focus.

WORKSHEET

1. In the following sketch, draw in the location of all light needed to take this portrait photograph:



2. Describe how much of a person should be seen in portrait photography.

A person should be photographed:

- A. Full length
- B. Half length
- C. Head and Shoulders

3. Name the three main elements of portrait photography.

The three main elements of portrait photography include:

- A. Pose
- B. Props
- C. Lighting

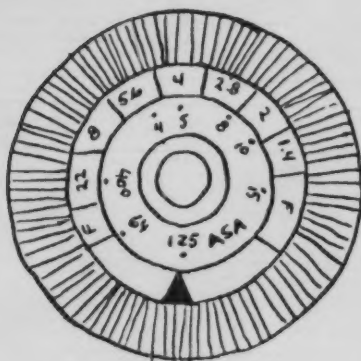
4. List six props which could be used when photographing someone.

Props which can be used in portrait photography include:

- | | | | |
|-------------|-----------|------------------|---------|
| A. Clothing | C. Smokes | E. Glasses | G. Etc. |
| B. Hat | D. Book | F. Sports Equip. | |

WORKSHEET

1. Look at this flash computer and answer the questions that follow:



- a. What ASA value has been set? ASA 125
- b. At a distance of 5 feet, what aperture setting should be used?

f 4

2. Name the four main sources of artificial light.

The four main sources of artificial light include:

- A. Flash cube
- B. X-flash cube
- C. Flash bar
- D. Electronic flash

3. Draw a diagram showing the method for bounce flash. Explain how to compute f - stops with this method.



A bounce flash is a flash beam reflected off a wall or ceiling to the subject. Exposure is computed by determining total distance and dividing this number into the guide number for your flash. Add one f-stop to this number to allow for some absorption and diffusion of light by the wall, floor or ceiling.

DRAFTER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- Drafting - Curves and Lettering, Moreland-Latchford Prod., 299 Queen St., Toronto, Ontario, Canada.
- Drafting Tips, Penn State University, Audio-Visual Aids Library, 17 Willard Bldg., University Park, Pa., 16802.
- Essentials of Drafting, Part 1, E. P. Research, Inc., Suite N Village Corner, Los Altos, Calif., 94022.
- Essentials of Drafting, Part 2, E. P. Research, Inc., Suite N Village Corner, Los Altos, Calif., 94022.
- Essentials of Drafting, Part 3, E. P. Research, Inc., Suite N Village Corner, Los Altos, Calif., 94022.
- Measure Length, Think Metric, Barr Films, 3490 E. Foothill Blvd., Pasadena, Calif., 91107.
- Multiview Drawing, Purdue University, Audio-Visual Center, Audio-Visual Production, Room 54 STEW, Lafayette, Ind., 47907.
- Orthographic Projection, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y., 10020.
- Selection of Dimensions, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y., 10020.
- Size Description, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y., 10020.

II. BOOKS

- Giesecke, Frederick E., Mitchell, Alva and Spencer, Henry C., Technical Drawing. New York: The Macmillan Company, 1958.
- Wallach, Paul I. Drafting. Chicago: American Technical Society, 1979.

III. EQUIPMENT AND SUPPLIES

Drafting instrument sets
 A5° triangles
 30/60° triangles
 T-squares
 Drafting boards
 Architects scales
 Lettering guides
 Tape, drafting
 Pencils, assorted drafting
 Paper, assorted
 Circle templates
 Protractors

WORKSHEET

1. In the space provided, make a vertical letter "A" and a slanted letter "A".

A
vertical

A
slanted

2. On the lines provided, practice making the vertical single stroke gothic letters shown.

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y
Z	1	2	3	4
5	6	7	8	9

3. On the lines provided, practice word and letter spacing by printing the phrase "PRACTICE MAKES SPACING EASY".

WORKSHEET

1. List the five types of drafting paper. Tell what each is used for.

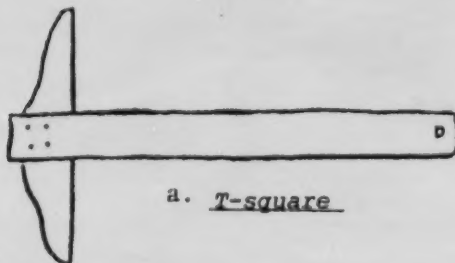
- A. drawing paper - general drafting
- B. tracing paper - general drafting, good for making blueprints
- C. vellum - general drafting, better than tracing paper
- D. polyester film - general drafting, best quality
- E. graph paper - freehand drawings

2. TRUE or FALSE. A 3H drafting pencil is harder than a 5B drafting pencil.

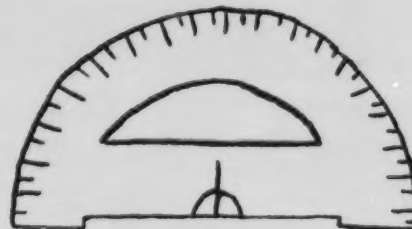
3. Why are there light lines and dark lines on a drawing.

Different weight lines have different meanings. Dark lines are object lines, light lines are for dimensions, hidden lines, center lines, section lines, etc.

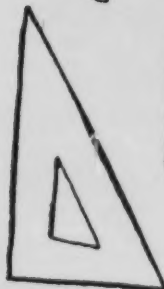
4. Identify the following drafting tools:



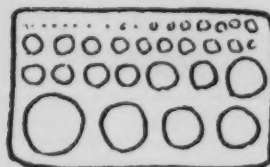
a. T-square



c. protractor



d. 30°/60°
triangle



b. circle
template



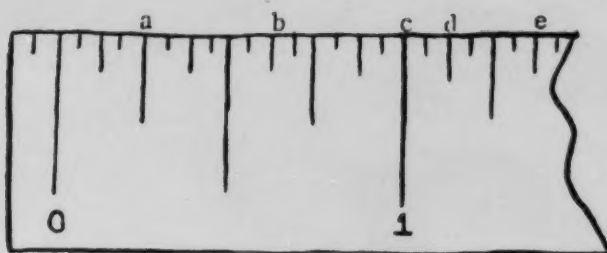
e. 45°
triangle



f. compass

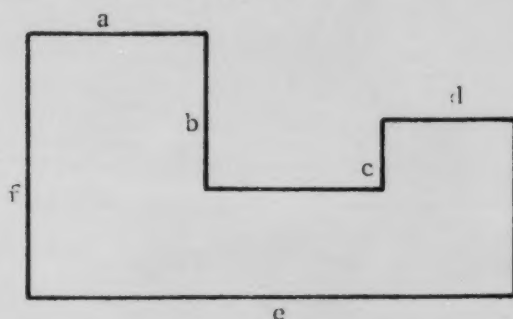
WORKSHEET

1. Identify the length shown by the letters on the following scale:



- a. $\frac{1}{4}$
 b. $\frac{5}{8}$
 c. 1
 d. $1 \frac{1}{8}$
 e. $1 \frac{3}{8}$

2. Use a mechanical scale to measure the lengths shown by the letters on the following drawing:



- a. 1
 b. $\frac{7}{8}$
 c. $\frac{3}{8}$
 d. $\frac{3}{4}$
 e. $2 \frac{3}{4}$
 f. $1 \frac{1}{2}$

3. List the metric units for measuring length.

- A. millimeter
 B. centimeter
 C. meter
 D. kilometer

WORKSHEET

1. Name the parts of a sheet layout.

- A. border lines
- B. title block
- C. lettering

2. Define size A and size B paper.

Size A paper is 8½ x 11 inches. Size B is 11 x 17 inches.

3. List the information included in most title strips on a sheet layout.

- A. Approved By
- B. Grade
- C. Drafting Level
- D. School
- E. Name of Part Drawn
- F. Name of Student
- G. Scale
- H. Date
- I. Drawing Number

WORKSHEET

1. Identify the following shapes:



a. equilateral triangle



b. square



c. pentagon



d. cone

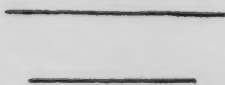
2. Perform the following geometric constructions.



a. Draw a perpendicular line from a point on a line



b. Bisect a line with a compass



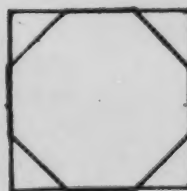
c. Draw a line parallel to another line



d. Bisect an angle with a compass



e. Draw an equilateral triangle



f. Draw an octagon inside a square

SHEET METAL WORKER
INSTRUCTIONAL RESOURCES

I. AUDIO-VISUAL

Blanking Sheet Metal on The Squaring Shear, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
Blanking Sheet Metal with Hand Snips, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
Forming on a Hand Operated Brake, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
Forming on Rotary Machines, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
Hand Soldering, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
Sheet Metal - Pattern Development, Sterling Educational Films, 241 E. 34th St., New York, N.Y. 10016.

II. BOOKS

Budzik, Richard S. Sheet Metal Technology. Indianapolis: Bobbs-Merrill Educational Publishing, 1971.

III. EQUIPMENT AND SUPPLIES

Scratch awl	Soldering furnace
Sheet metal snip assortment	Electric soldering iron w/tips
Squaring shear	Sheet metal, assorted
Steel rule (36")	Drafting board
Assortment sheet metal stakes	T-square
Bench vise	30/60° triangle
Barfolder	45° triangle
Cornice brake	Pliers
Box and pan brake	Wrench, crescent
Roll former	Wire, heavy gage
Hand groover	Hand drill
Rotary machine	Drill bits
Slip roll	Center punch
Mallet	Screwdriver
Hammer	Screws, sheet metal
Soldering copper	Pop rivet gun
	Pop rivets

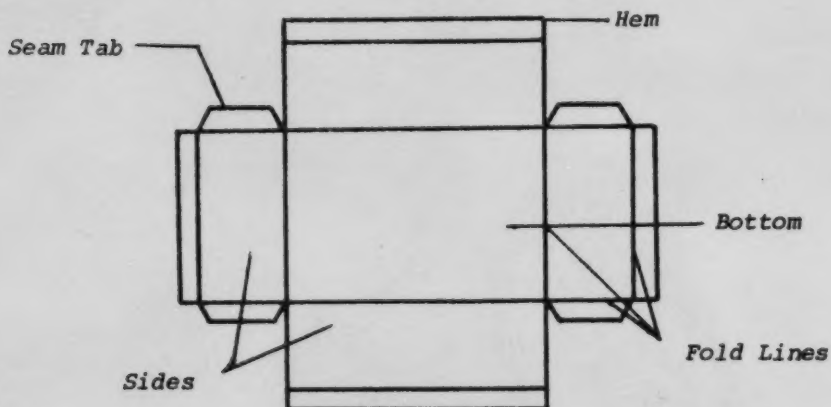
WORKSHEET

1. Define the following terms:

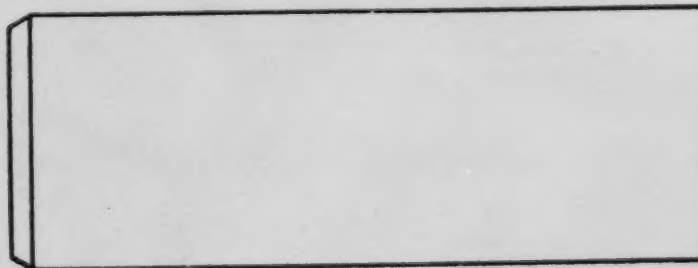
- a. Hem - A folded edge used to increase the strength of the work, eliminate sharpness and improve appearance.
- b. Wired Edge - A type of hem formed on funnels, trays and pails.
- c. Seam - A joint between sheet metal edges.
- d. Notch - The removal of metal allowing ease in forming sheet metal products and eliminating excess bulky material.

2. Sketch the development of a simple box. Label the following:

- a. bottom
- b. sides
- c. hem
- d. seam tabs
- e. fold lines



3. Sketch the development of a simple cylinder.



4. Name the four methods of pattern development:

The four methods of pattern development include:

- A. Straight-Line
- B. Parallel-Line
- C. Radial-Line
- D. Triangulation

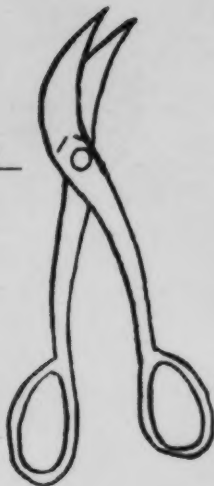
WORKSHEET

1. Define scratch awl.

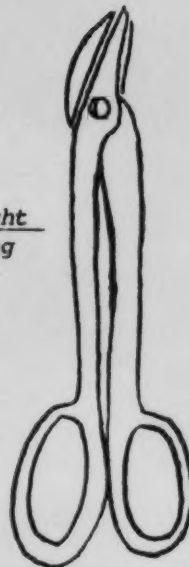
A scratch awl is a tool used to mark the cutting lines when transferring a pattern to sheet metal.

2. Identify the following tools:

a. Hawkbill
Snips



b. Straight
Cutting
Snips



c. Aviation
Snips



3. Explain how to adjust the back gage of the squaring shears.

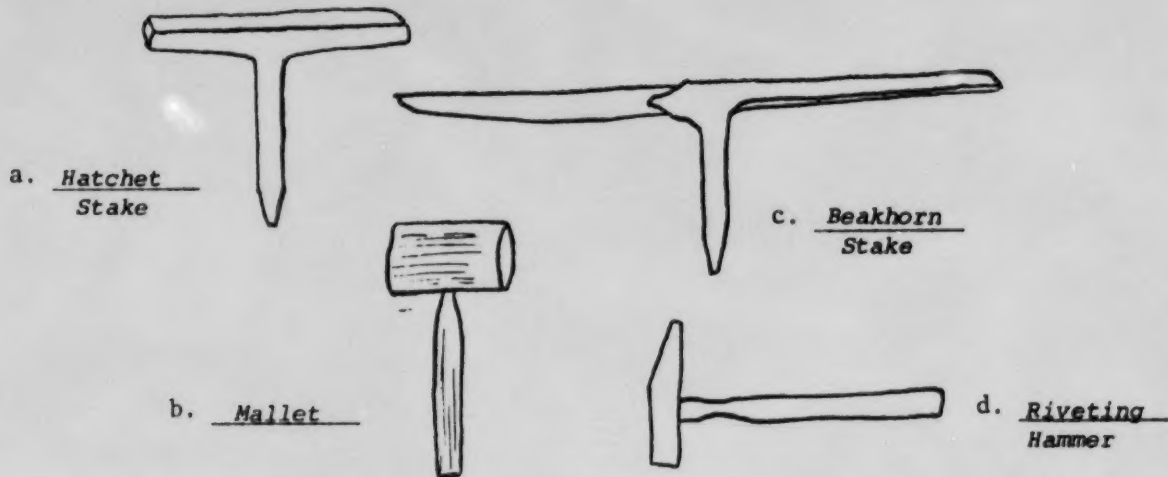
The back gage of the squaring shears is adjusted to the width of the desired cut. Care must be made to insure that the back gage is square with the side gages.

4. How do you cut an inside hole on a sheet metal project?

When cutting an inside hole on a sheet metal project, drill or punch holes in the waste stock large enough to allow sheet metal snips to start. Then insert the snips from below and cut to within 1/4" of the line. Finally, cut the hole to size.

WORKSHEET

1. Identify these tools:



2. Explain two ways to bend sheet metal by hand.

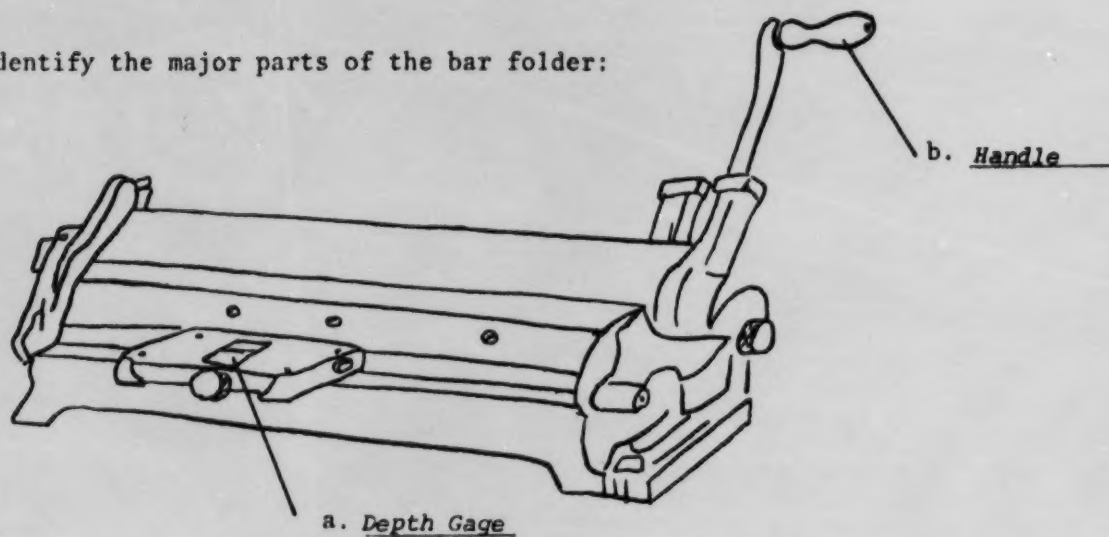
Two ways to bend sheet metal by hand include:

- A. Hold the sheet metal between two pieces of hardwood in a vise and bend the metal by striking it with a hammer.
- B. Hold the sheet metal with the fold line over a hatchet stake and bend with the hands. Sharpen the bend by striking it with a hammer.

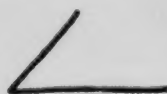
3. TRUE or FALSE. When making bends or curves in sheet metal, never hit it with a mallet as it will leave dents.

WORKSHEET

1. Identify the major parts of the bar folder:



2. Draw the different bends which can be made on the bar folder.



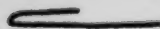
Sharp Fold



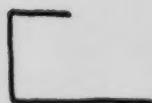
Right Angle Fold



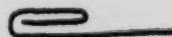
Round Fold



Single Hem



Right Angle Folds

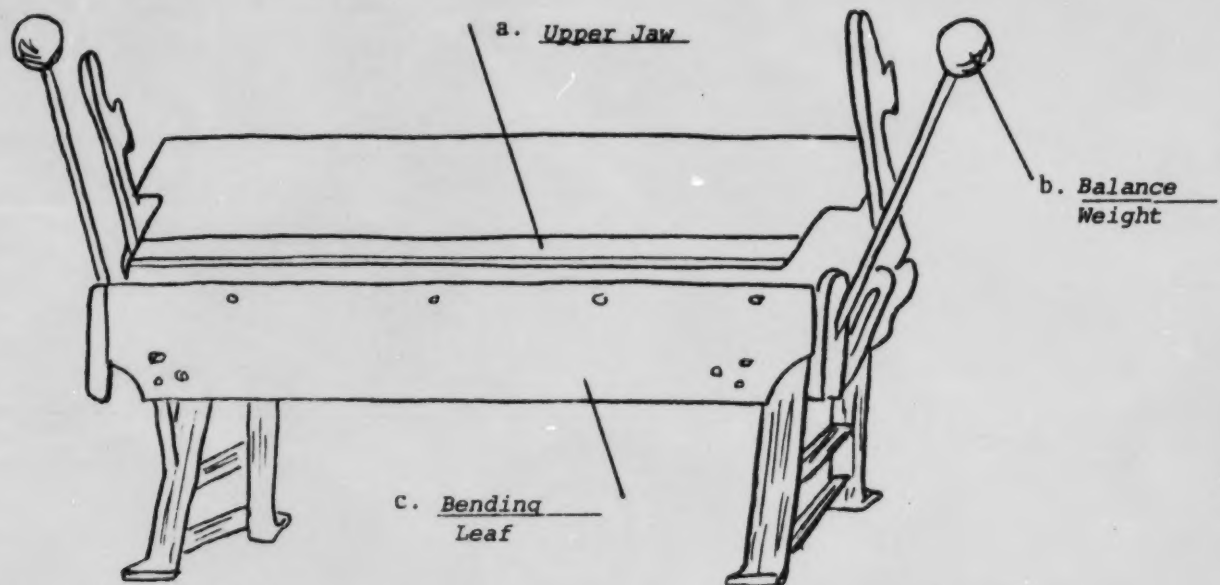


Double Hem

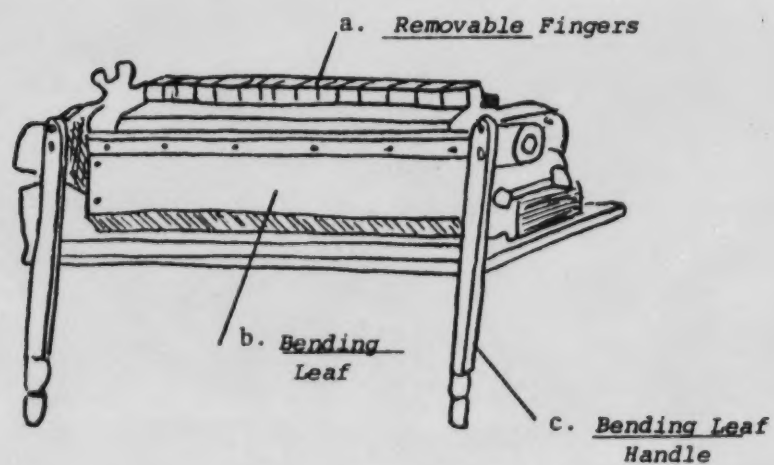
3. TRUE or FALSE. On the bar folder, the amount of bend to be made is set on the depth gage.

WORKSHEET

1. Identify the parts of the cornice brake:

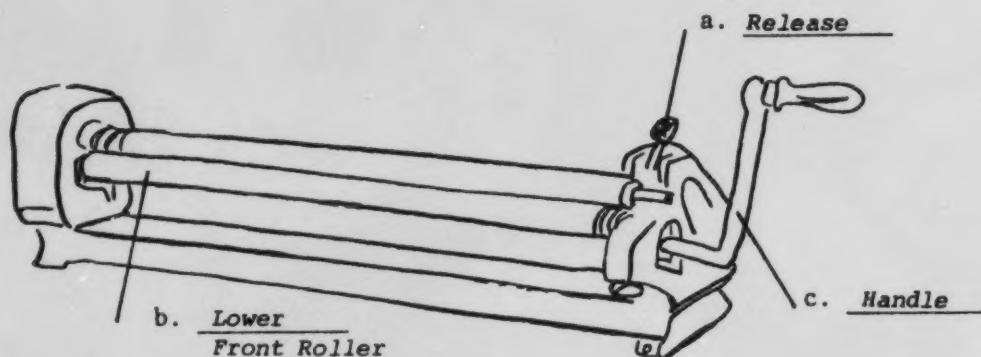


2. Identify the parts of the box and pan brake:



WORKSHEET

1. Identify the major parts of the roll forming machine:



2. Why do some rollers have grooves in them?

Some rollers have grooves in them to allow the forming of cylinders which have wired edges.

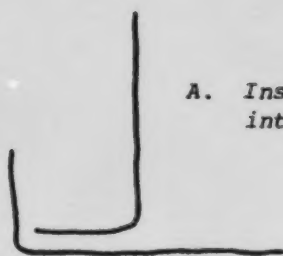
3. Why is the upper roller removeable?

The upper roller can be raised to allow the formed cylinder to be removed from the roll-forming machine.

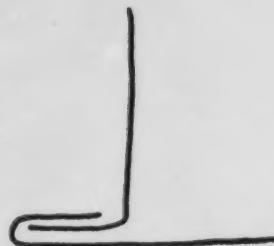
4. TRUE or FALSE. To form a sharp bend on sheet metal, use the roll forming machine.

WORKSHEET

1. Draw the steps in making a single seam on a straight-edged container.

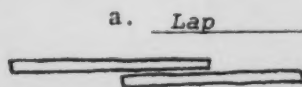


A. Insert the body
into the bottom.



B. Bend the flange
of the bottom over
the flange of the
top.

2. Identify the following seams:



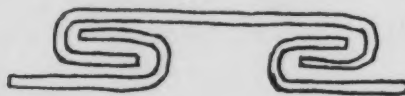
a. Lap



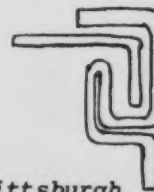
b. Single



c. Grooved



d. Cap Strip

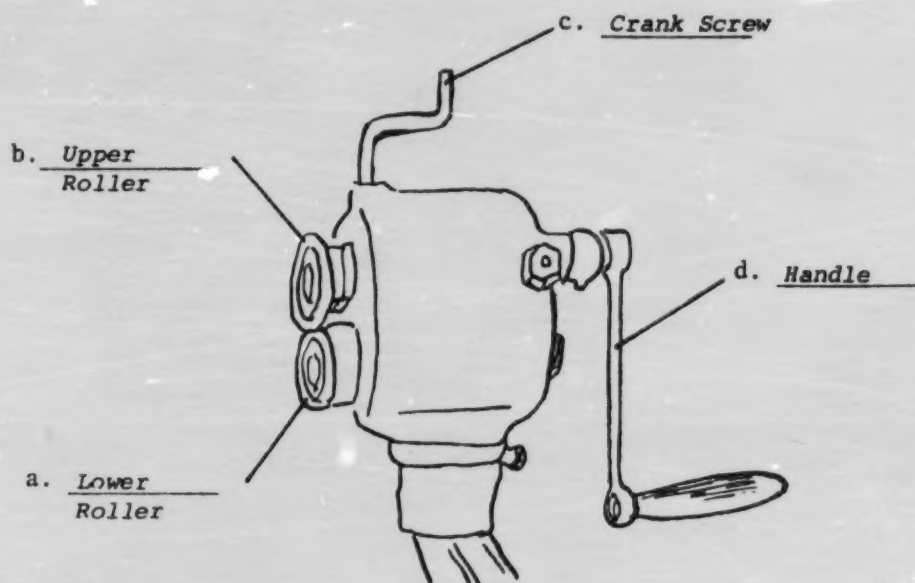


e. Pittsburgh

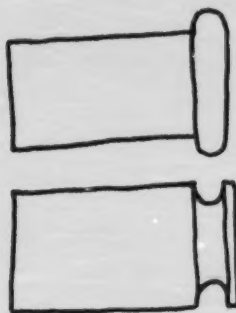
3. MULTIPLE CHOICE. When putting a bottom on a can, the strongest joint would be (a) double seam (b) outside lap seam (c) lap bottom seam (d) wired edge.
4. TRUE or FALSE. The cap strip seam is used for putting lids on metal boxes.

WORKSHEET

1. Identify the parts of the rotary machine:



2. Draw a picture showing what the turning rolls of a rotary machine looks like.



3. Name five operations which can be done on a rotary machine.

Five operations which can be done on a rotary machine include:

- | | |
|-------------|----------------------|
| A. Beading | D. Flange Forming |
| B. Crimping | E. Wire Edge Forming |
| C. Slitting | |

WORKSHEET

1. Why do some pop rivets have enamel paint on their heads?

Some pop rivets have enamel paint on their heads to match the color of the metal to which they are attached.

2. Identify these screw head styles:

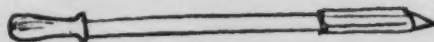


- a. Round b. Flat c. Hexagon d. Oval e. Truss

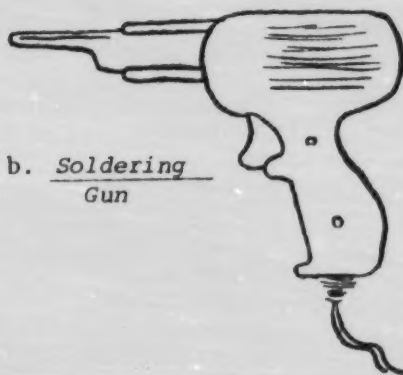
3. What is the difference between thread cutting and thread forming sheet metal screws?

The main difference between sheet metal screws is that thread cutting screws remove metal during the forming of threads and thread forming screws displace metal.

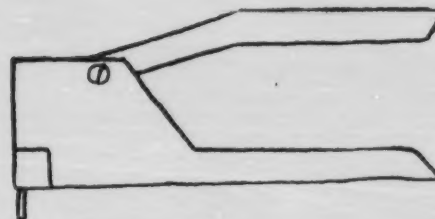
4. Identify the following:



- a. Soldering Copper



- b. Soldering Gun



- c. Pop Riveter

MACHINIST

INSTRUCTIONAL RESOURCES

I. AUDIO-VISUAL

- Cutting an External National Fine Thread, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Cutting Threads with Taps and Dies, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Drilling, Boring and Reaming Work Held in a Chuck, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- The Drill Press, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Facing on the Lathe, E. P. Research, Inc., Suite N Village Corner, Los Altos, Calif. 94022.
- Grinder and Buffer, BFA Educational Media, 2211 Michigan Ave., P.O. Box 1795, Santa Monica, Calif. 90406.
- The Lathe, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- The Micrometer, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- The Milling Machine, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Rough Turning Between Centers, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Steel Rule, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.

II. BOOKS

- Boyd, Gardner. Metalworking. Homewood: The Goodheart-Willcox Co., Inc., 1968.
- Johnson, Harold V. Technical Metals. Peoria: Chas. A. Bennett Co., Inc., 1973.
- Little, Richard and Little, Sherry. Metalworking. Chicago: American Technical Society, 1979.
- Ludwig, Oswald A. Metalwork Technology and Practice. Bloomington: McKnight & McKnight Publishing Company, 1962.

III. EQUIPMENT AND SUPPLIES

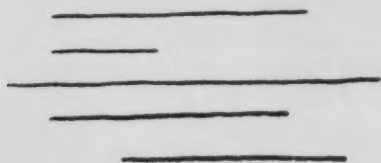
- | | |
|---------------------------|-------------------------------|
| Steel rule | Bench vise |
| Caliper assortment | Combination square |
| Micrometer assortment | Oil can |
| Tap and die set | Metal file assortment |
| Electric hand drill | Metal lathe w/assessories |
| Drill press | Milling machine w/assessories |
| Ball peen hammer | Bench grinder |
| Center punch | Wheel dresser |
| Grinding wheels, assorted | 1/4" drill rod |
| 3/8" steel plate | Drill bits, assorted |
| Screwdrivers, assorted | Allen wrenches, assorted |
| 1" steel rod | Wrench, adjustable |
| 1/2" steel plate | Drill gage |

WORKSHEET

1. Name the divisions on a steel rule.

- | | |
|-------------------|------------|
| A. sixty-fourths | D. eighths |
| B. thirty-seconds | E. fourths |
| C. sixteenths | F. halves |

2. With the steel rule, measure these lines and name the length in the space provided.



a. 1 1/2

b. 5/8

c. 2 1/8

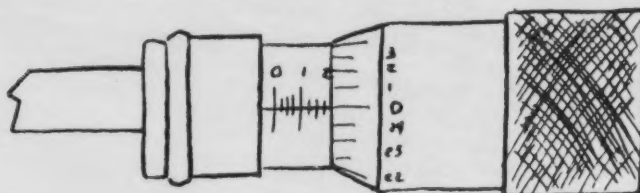
d. 1 3/8

e. 1 5/16

3. How is a caliper setting measured?

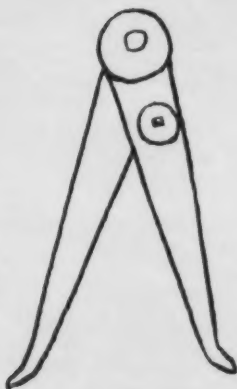
Once a caliper (inside or outside) is adjusted, it is compared to a steel rule for accurate measurement.

4. Read the following micrometer setting:

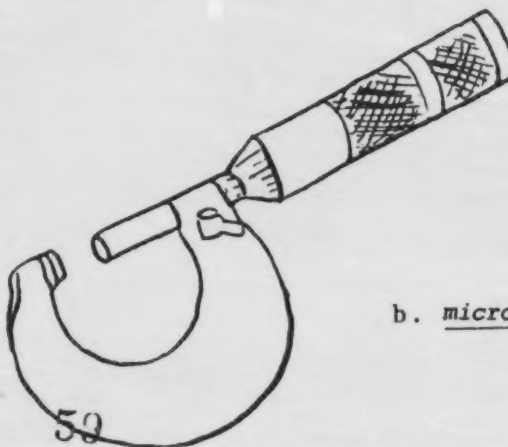


.200 inch

5. Identify the following tools:



a. inside
caliper



b. micrometer

WORKSHEET

1. Draw the different thread forms and explain what they are used for.



American national
(general use)



unified
(General use in US, UK, and Canada)

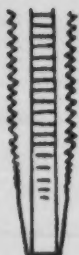


acme
(power transmission)



square
(power transmission)

2. Draw the different kinds of taps and explain what they are used for.



taper



plug



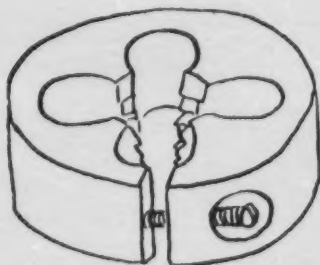
bottoming

A taper tap cuts either all the way through or far enough to start the plug tap. The plug and bottoming taps are used in blind holes.

3. TRUE or FALSE When cutting internal threads with a $\frac{1}{4}$ -20NC tap, one must first drill a hole with a $\frac{1}{4}$ " drill bit.
4. Why must the end of the stock be tapered when cutting threads with a die?

The end of the stock must be tapered when cutting threads with a die so that the die can start cutting easily.

5. Identify this tool:



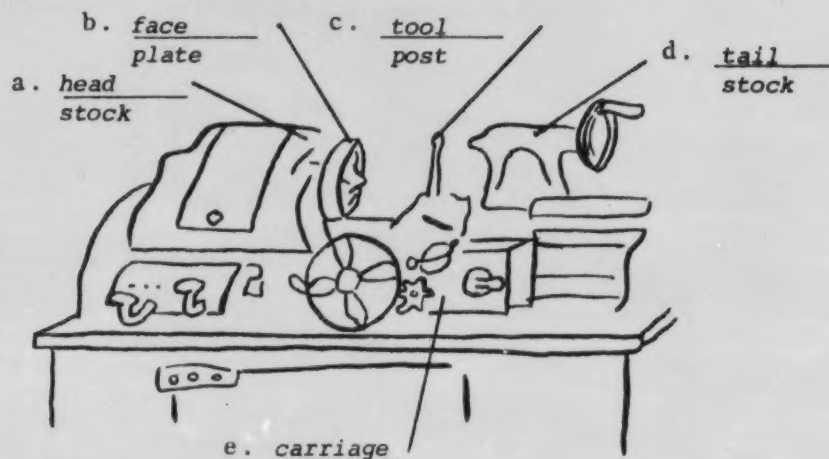
round adjustable
split die

WORKSHEET

1. Name some objects made on a lathe.

- | | |
|-------------------|------------------|
| A. handles | E. screw drivers |
| B. scribes | F. etc. |
| C. center punches | |
| D. marking gage | |

2. Identify the parts of the lathe:



3. Draw a picture of a right rough cutting bit for the metal lathe.



4. Explain how the size of a lathe is designated.

The size of a lathe is designated by its swing and the length of the bed. A 13" x 5' lathe is one having the capacity to freely rotate a 13" diameter workpiece and having a bed 5' long.

WORKSHEET

1. Why is round stock usually held in a chuck when it is being centerdrilled?

Round stock held in a chuck during the centerdrilling operation is automatically "on-center" and does not require locating and punching.

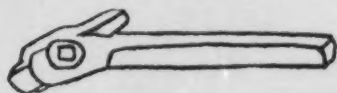
2. When facing stock between centers, why should you use a half center in the tail stock?

The use of a half center in the tail stock during facing allows a complete facing job without interference between cutting tool and center.

3. Why must the cutting tool be exactly on center when facing stock on the lathe?

If the cutting tool is not exactly on center when facing stock, the stock cannot be totally machined as the bit will be too high or too low. There also is the danger of accident with an improperly adjusted tool bit.

4. Identify these tools:



a. right hand offset
toolholder

b. bent tail dog



WORKSHEET

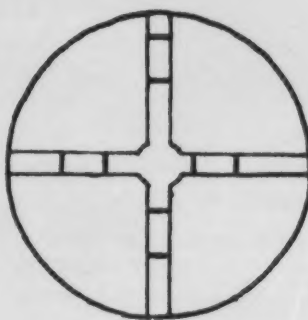
1. What is rough turning? finish turning?

Rough turning means bringing the stock quickly to the approximate final size. Finish turning is slowly bringing the stock to finished size with fine adjustments and smooth cuts.

2. Draw and describe the two types of chucks.



3 jaw universal
(all jaws move together)



4 jaw independent
(all jaws move independently)

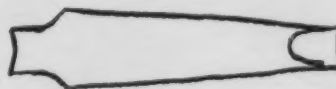
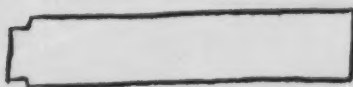
3. TRUE or FALSE Setting the cutting tool for a cut of $\frac{5}{1000}$ inch will actually result in removing $\frac{10}{1000}$ inch from the stock.

WORKSHEET

1. Why must the workpiece be centerdrilled before it is drilled on the lathe?

A workpiece must be centerdrilled to avoid having the drill bit "walking" around the face of the stock. In other words, this will insure that the drill will start on center.

2. Identify the shanks on these drill bits:



a. straight

b. taper

3. What is the purpose of cutting oil in the drilling operation?

The cutting oil will help avoid binding the drill bit, aid in the removal of chips and improve the quality of the cut.

WORKSHEET

1. How does a milling machine work?

The milling machine uses a revolving cutting bit that cuts a workpiece held on a worktable.

2. Identify these milling machines:



a. horizontal



b. vertical

3. Name three types of milling machine cutters.

Examples of milling machine cutters include:

- | | | |
|-----------------|--------------------|------------------|
| A. plain | D. formed | G. woodruff key- |
| B. slitting saw | E. staggered tooth | seat |
| C. side mill | F. shell | H. face |

4. Name some of the operations which can be done on a vertical milling machine.

- | | |
|---------------------|----------------------|
| A. flat machining | E. milling key seats |
| B. angled machining | F. facing |
| C. boring | G. etc. |
| D. dovetailing | |

WORKSHEET

1. Why does the drill press table have a large hole in the middle of it?

The large hole in the middle of a drill press table is to allow a drill bit to go through a workpiece and not damage the table.

2. Drill sizes are designated in four ways. Name them.

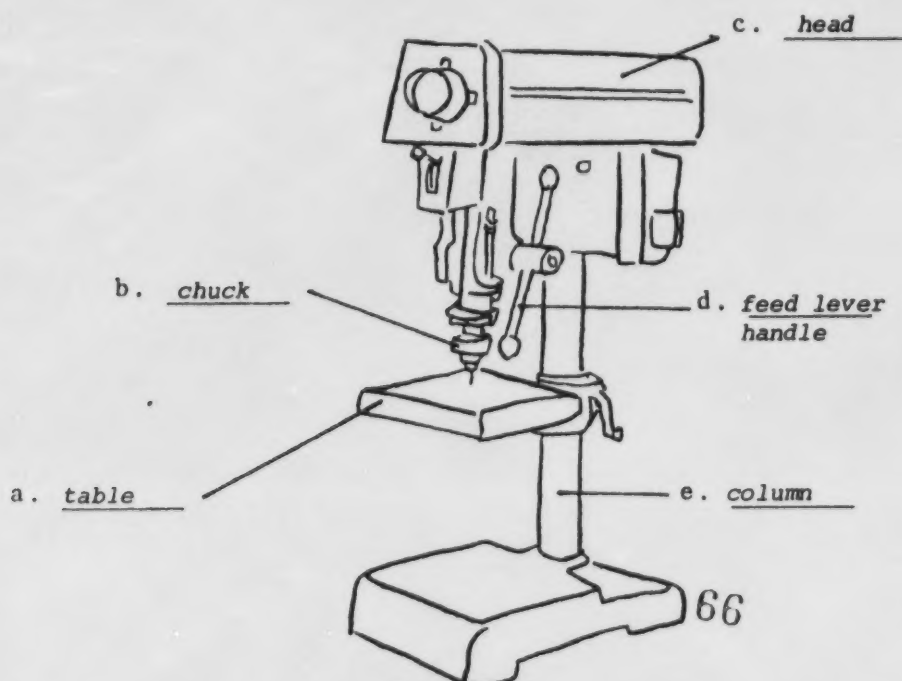
- A. *fractions*
- B. *numbers (wire gage size)*
- C. *alphabetical*
- D. *millimeters*

3. What is a drill gage?

A drill gage is a metal plate used to determine the size of an unknown drill.

4. TRUE or FALSE A number 2 drill bit makes a larger hole than a 3/16 drill bit.

5. Name the parts of a drill press:



WELDER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

Arc Welding Electrode Selection, Hobart Brothers Manufacturing Co.
The Cutting Torch - Flamecutting, BFA Educational Media, 2211
Michigan Ave., P.O. Box 1795, Santa Monica, Calif. 90406.
Flame-Cutting, Linde Air Products, Co.
Oxyacetylene Welding - Equipment, BFA Educational Media, 2211
Michigan Ave., P.O. Box 1795, Santa Monica, Calif. 90406.
Oxyacetylene Welding - Torch Techniques, BFA Educational Media,
2211 Michigan Ave., P.O. Box 1795, Santa Monica, Calif. 90406.

II. BOOKS

Giachino, J.W., Johnson, G.S. and Weeks, W.R. Welding Technology.
Chicago: American Technical Society, 1979.

III. EQUIPMENT AND SUPPLIES

Oxy-Acetylene welding set (torch, regulators, etc.)
Tip cleaner
Goggles
Spark lighter
Cutting torch w/tips
Arc-welder complete
Chipping hammer
Wire brush
Welding hood
 $\frac{1}{4}$ " steel plate
Filler rod
6012 welding rods
Welding gloves
Welding jacket
Bench grinder
Grinding wheels, assorted

WORKSHEET

1. Define Welding.

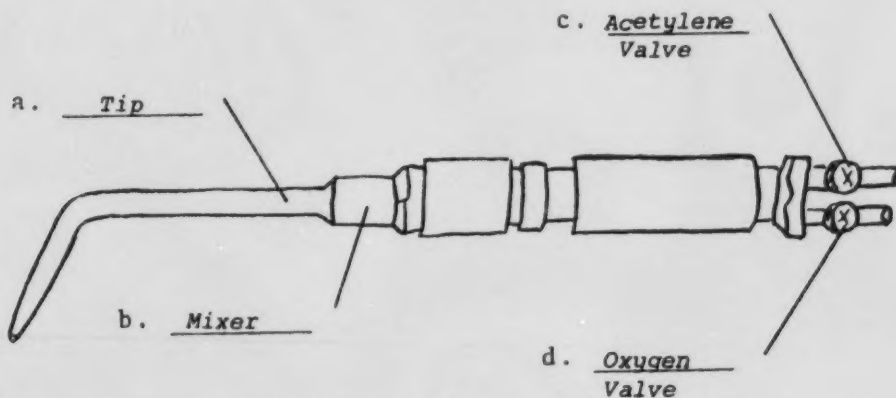
Welding is the process of joining metal by melting and fusion.

2. Tell some safety rules about the use of gas welding equipment.

Some safety rules in using gas welding equipment includes:

- A. Keep cylinders chained in an upright position.*
- B. Only use oxygen through a regulator.*
- C. Avoid rough handling of cylinders.*
- D. Always wear goggles when welding.*
- E. Never light the torch with both valves open.*

3. Name the parts of the welding torch:



4. What safety devices are used to stop cylinders from exploding from intense pressure?

In the case of intense pressure, all cylinders have safety plugs to eliminate any possible explosion.

WORKSHEET

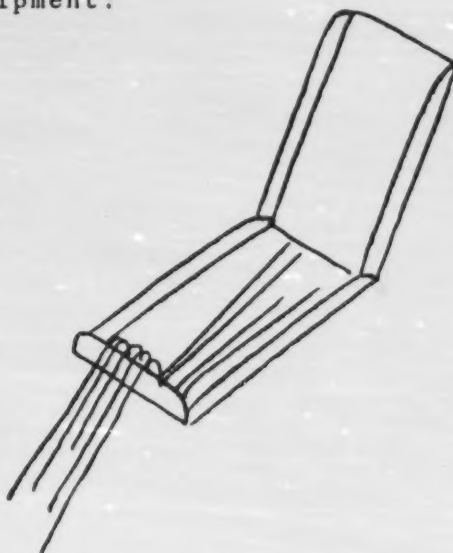
1. Why are there two gages on most regulators?

A regulator has two gages; one indicating pressure in the cylinder and the other the working pressure at the torch.

2. Multiple Choice. The tip size you would use to weld $\frac{1}{4}$ " steel plate is: (a) 2 (b) 3 (c) 5 (d) 7

3. Identify this piece of equipment:

Tip Cleaners



4. TRUE or FALSE. A #7 welding tip is a bigger size than a #4 tip.
5. TRUE or FALSE. Always turn the oxygen on first when lighting the torch.
6. How is an oxygen hose different from an acetylene hose?

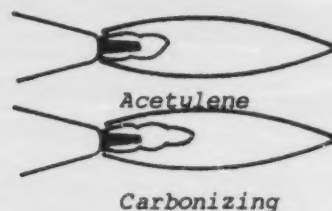
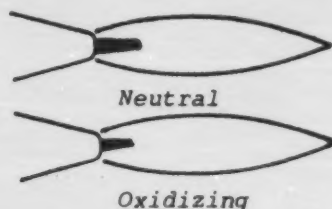
The hoses differ in color (red and green) and in coupling threads.

7. Why should the acetylene be shut off first?

The acetylene should be shut off first to avoid the problem of excess soot.

WORKSHEET

1. Describe the four types of welding flames.



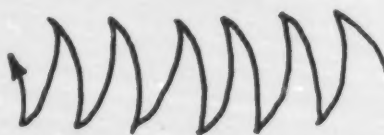
2. How is a neutral flame produced?

A neutral flame is produced by burning the correct mixture of oxygen and acetylene.

3. What causes the flame to "pop"?

An oxyacetylene flame may "pop" due to an inadequate flow of one or both gases.

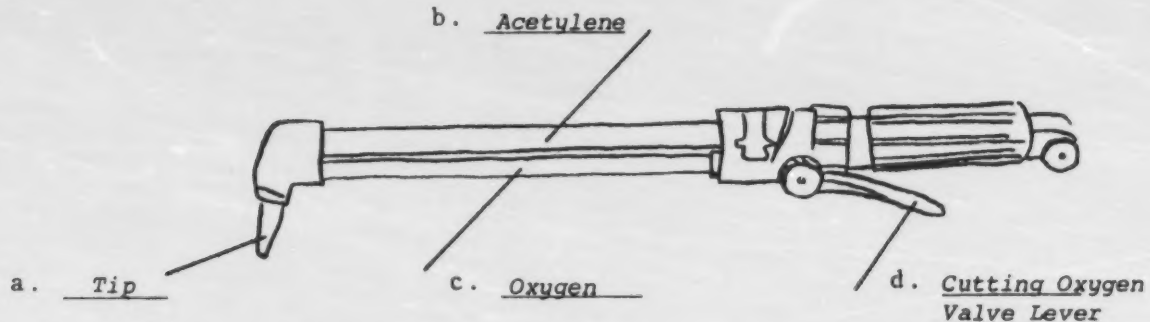
4. Draw a picture and tell how to draw a bead with a filler rod.



While moving the torch in the manner shown in the sketch, raise and lower the filler rod into the puddle to build up the weld to the desired height.

WORKSHEET

1. Identify the major parts of the cutting torch:



2. What is flame cutting?

Flame cutting is a process of cutting metal by heating, then directing a stream of oxygen on the spot to be cut. This blast of pure oxygen causes rapid oxidation of the metal.

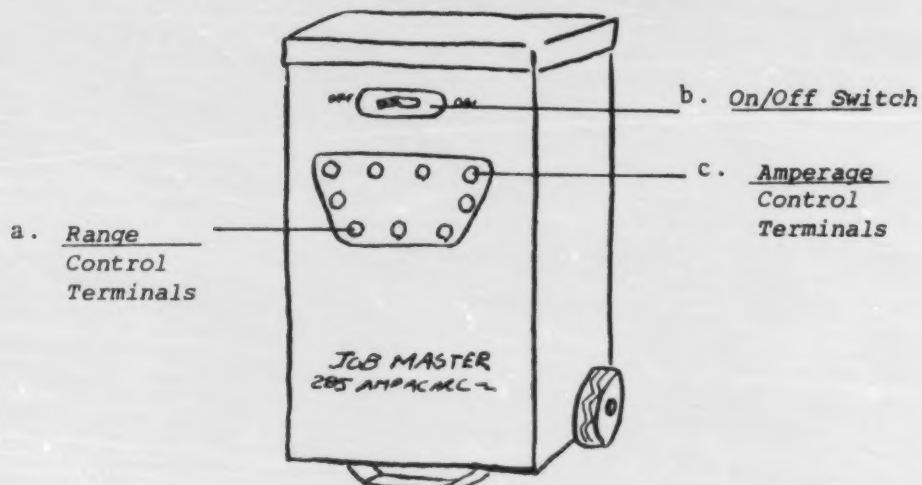
3. What cutting torch tip should you use to flame cut $\frac{1}{4}$ " steel plate?

"O"

4. TRUE or FALSE. A #3 cutting torch tip is smaller than a #2 tip.
5. TRUE or FALSE. In Flame cutting, oxygen and acetylene pressures are always the same.
6. TRUE or FALSE. The metal should be heated bright red before you attempt to cut it.

WORKSHEET

1. Identify the parts of the arc welding machine:



2. How does arc welding differ from gas welding?

Arc welding joins metal by heat from an electric arc where gas welding heats by the flame of burning gases.

3. Why is the viewing filter in a welding hood so dark?

The viewing filter (#10) in a welding hood is dark to protect your eyes from the bright sparks produced in arc welding.

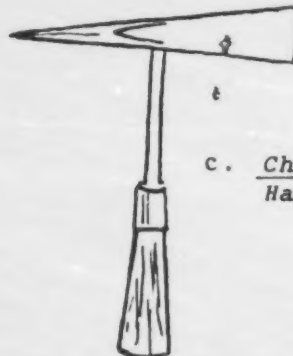
4. Identify this equipment:



a. Welding Hood



b. Electrode Holder



c. Chipping
Hammer

WORKSHEET

1. What is an E6012 welding electrode used for?

An E6012 welding electrode is used to weld ferrous metals with medium penetration. The electrode produces heavy slag with a soft arc.

2. What current mode and amperage setting would be used for an E6012 electrode which has a rod diameter of 1/8" (.125 inch).

A current mode of either D.C. straight polarity or A.C. with a setting of 125 amps would be used with an E6012 electrode.

3. What does the coating on the electrode do?

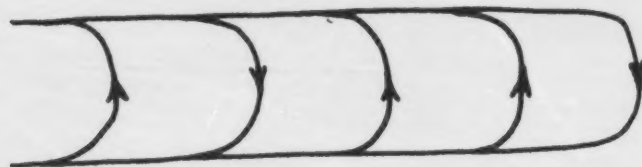
The coating on an electrode serves as a flux to aid in the flow molten metal, cleans the surface of the base metal and increases arc stability.

4. What is polarity?

Polarity refers to the direction of electron flow during welding.

WORKSHEET

1. Draw pictures and describe the four methods of weaving the electrode.



U-Shaped



Straight Crossover

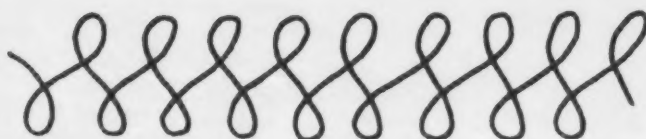
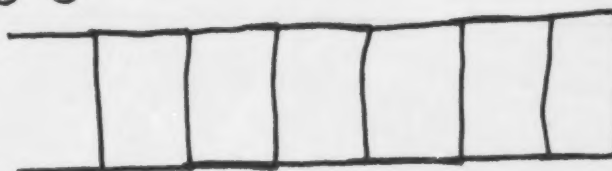


Figure Eight



Box Shaped

2. Describe the whip method of electrode movement.

The whip method of electrode movement is not a weaving motion, but rather involves moving the electrode into the puddle and out again. The electrode is moved in the direction of the weld bead.

3. Why is the correct welding speed important in obtaining a good weld?

If the electrode is moved too slowly, an excessive bead will pile up. If the electrode is moved too fast, the weld bead will be too small.

MOTOR REPAIRER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

Circuit Testing with Meters and Multimeters, U.S. Army, The Pentagon, Washington, D.C. 20310.
DC Motors, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
Electricity - The Generator and The Motor, Universal Educ. and Visual Arts, 100 Universal City Plaza, Universal City, Calif. 91608.
Electric Motors, Encyclopedia Britannica Films.
Fundamentals of AC and DC Generators, General Electric Educational Films, Corporation Park Bldg. 705, Scotia, N.Y. 12302.
Lubrication of Electronic Equipment, U.S. Navy Department, Office of Information, Pentagon Bldg., Washington, D.C. 20350.
Series-Parallel Resistive Circuits - Circuit Analysis, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
Transformers - Laboratory, Encyclopedia Britannica Films.
Use of Voltmeter, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

II. BOOKS

Anderson, Edwin P. and Miller, Rex. Electric Motors. Indianapolis: Bobbs-Merrill Educational Publishing, 1977.
 Heath, Larry and Winn, Charles S. Exploring Occupations in Electricity and Electronics. New York: Gregg Division McGraw-Hill Book Company, 1976.
 Kaufman, Milton and Wilson, J.A. Basic Electricity Theory and Practice. New York: McGraw-Hill Book Co., 1973.
 Sutton, Mack C. Electric Motor Repairman. Austin: Texas Education Agency, 1973.
 Van Valkenburgh, Nooger and Neville, Inc. Basic Electricity, Vol. 1. New York and John F. Rider Publisher, Inc., 1954.
 _____. Basic Electricity, Vol. 2. New York: John F. Rider Publisher, Inc., 1954.
 _____. Basic Electricity. Vol. 3. New York: John F. Rider Publisher, Inc., 1954.
 _____. Basic Electricity. Vol. 4. New York: John F. Rider Publisher, Inc., 1954.
 _____. Basic Electricity, Vol. 5. New York: John F. Rider Publisher, Inc., 1954.

III. EQUIPMENT AND SUPPLIES

VOM meter	D cell batteries
Screwdriver assortment	1" iron rod
Prewired practice circuits	AC electric motors, assorted
Resistors, assorted	Screwdrivers, assorted
Alligator wire leads	Nut drivers, assorted
Insulated wire, assorted	Transformers, assorted
Solder	DC electric motor
Soldering gun	Generator
Alligator clips	Electric contact cleaner
AC voltage supply	Oil, lubricating

WORKSHEET

1. Define watt.

Watt is the rating for electrical power.

2. State the Power Law.

Watts equals volts multiplied by current.

$$P = E \times I$$

3. Using the Power Law, solve the following problems.

- a. How much current is used by a light rated at 12 volts and 20 watts?

1.66 amps

- b. How much power is used by a radio rated at 120 volts and .1 amperes of current?

12 watts

- c. What is the voltage rating of a toaster if it consumes 1200 watts of power and used 10 amperes of current?

120 volts

4. TURE or FALSE. A kilowatt is 100 watts.

5. TRUE or FALSE. It would be cheaper to listen to a 10 watt radio for one hour than to listen to 50 watt stereo tape player for fifteen minutes.

WORKSHEET

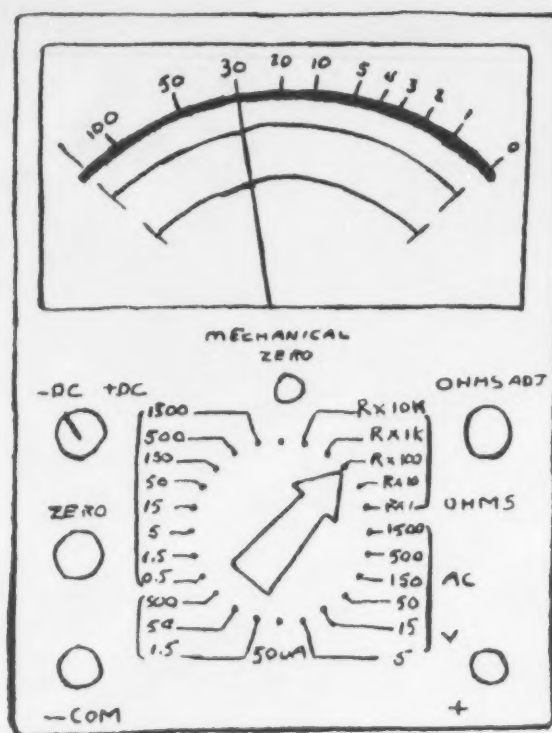
1. What is each scale of the vom used for?

There are three scales on a typical vom:

- A. DC voltage, AC voltage and current in milliamperes
- B. Resistance in ohms
- C. AC voltage of less than 15 volts

2. TURE or FALSE. The electronic type vom which uses vacuum tubes is called a VTVM.

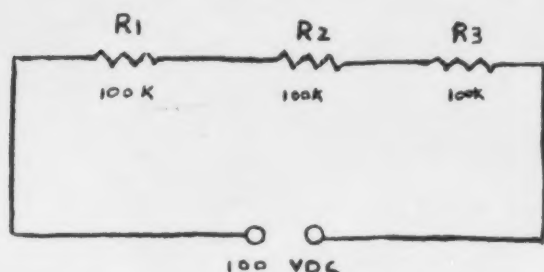
3. Look at the following meter and tell what the needle reads.



3000 ohms

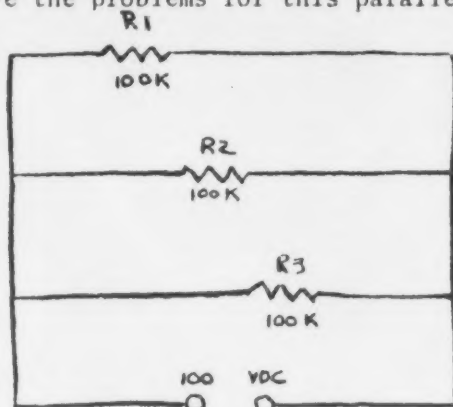
WORKSHEET

1. Solve the problems for this series circuit:



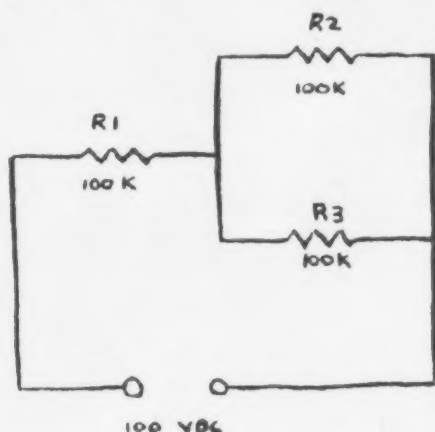
- What is the voltage drop at R_1 ? 33.3 volts
- What is the current at R_2 ? .0003 amps
- What is the total resistance of the circuit? 300 K ohms

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? 100 volts
- What is the current at R_2 ? .001 amps
- What is the total resistance of the circuit? 33.3 K ohms

3. Solve the problems for this series-parallel circuit:



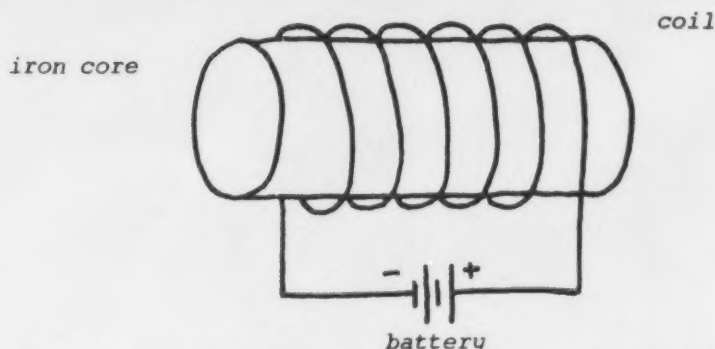
- What is the voltage drop at R_1 ? 66.6 volts
- What is the voltage drop at R_2 ? 33.3 volts
- What is the current at R_3 ? .0003 amps
- What is the total resistance of the circuit? 150 K ohms

WORKSHEET

1. Explain the role of electrons in an electromagnet.

Electrons, flowing through a wire, produce a magnetic field. This magnetic field can be increased by winding the wire into a coil and adding an iron core.

2. In the space provided, draw a simple electromagnet and label the parts.



3. List four things which affect the strength of an electromagnet.

Four things which affect the strength of an electromagnet are:

- A. the core
- B. the coil
- C. the number of turns in the coil
- D. the amount of current

4. Define the left-hand rule for electromagnets.

The left-hand rule determines the direction of the magnetic field in a wire. "If the wire is grasped in the left hand with the thumb pointing in the direction of current flow, the fingers will indicate the direction of the magnetic field."

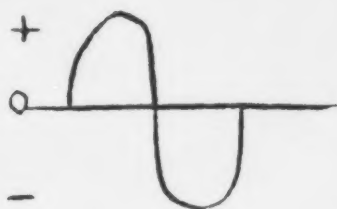
5. TRUE or FALSE. Electrons moving through a wire create a magnetic field.

WORKSHEET

1. Define alternating current.

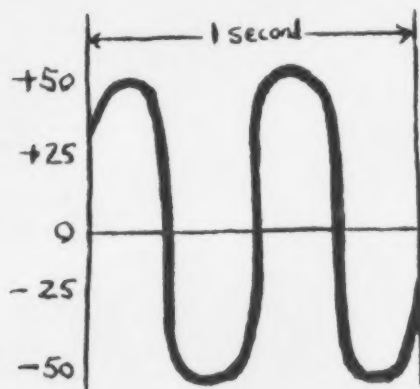
Alternating current is the flow of electrons through a circuit first in one direction and then the other.

2. Identify the following figure and explain its meaning for alternating current:



This figure is a graph called a sine wave. It indicates the flow of current as it alternates direction through a circuit.

3. From the figure below, compute the following:



- a. peak voltage 50 volts
 b. RMS 35 volts
 c. frequency 2 Hz

4. Explain how an armature in a magnetic field makes alternating current.

As the armature coil rotates through the magnet, the output voltage changes constantly. This is caused when the armature moves close to the magnet, then rotates away.

WORKSHEET

1. Define transformer.

A transformer is a coil of wire wound around an iron core.

2. What kind of current is a transformer often used with?

Alternating current is most often used with transformers.

3. A transformer has a primary winding of 50 turns and a secondary winding of 500 turns. If 120 volts AC is connected to the primary, what will be the voltage at the secondary?

1200 volts AC

4. If the transformer in question 3 had only 5 turns in the secondary what would the secondary voltage be?

12 volts AC

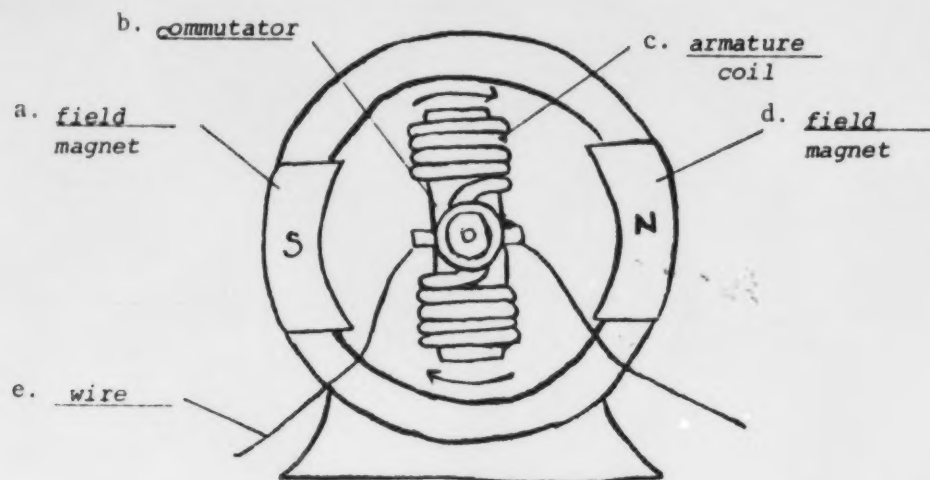
5. How does a transformer operate?

A transformer operates by a process of induction. A voltage is induced in a secondary coil by placing it in the magnetic field of a primary coil.

6. TRUE or FALSE. The power found in the primary of a transformer always equals the power in the secondary.

WORKSHEET

1. Identify the parts of the DC motor:



2. Tell the roles of the following motor parts:

- a. brushes - provide electrical contact between commutator and power source.
- b. slip rings - mount on the shaft and are used where switching current is not required.
- c. commutators - mount on the shaft and are used where switching current is required.

3. TRUE or FALSE. The electromagnet in a motor is called the armature.

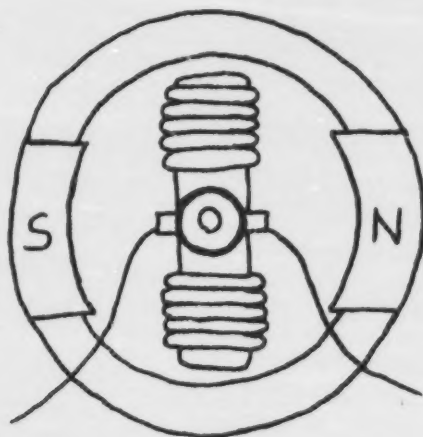
4. TRUE or FALSE. The fixed magnets in a motor are called brushes.

WORKSHEET

1. Explain why brushes are made of graphite.

Brushes are made of graphite because they provide their own lubrication.

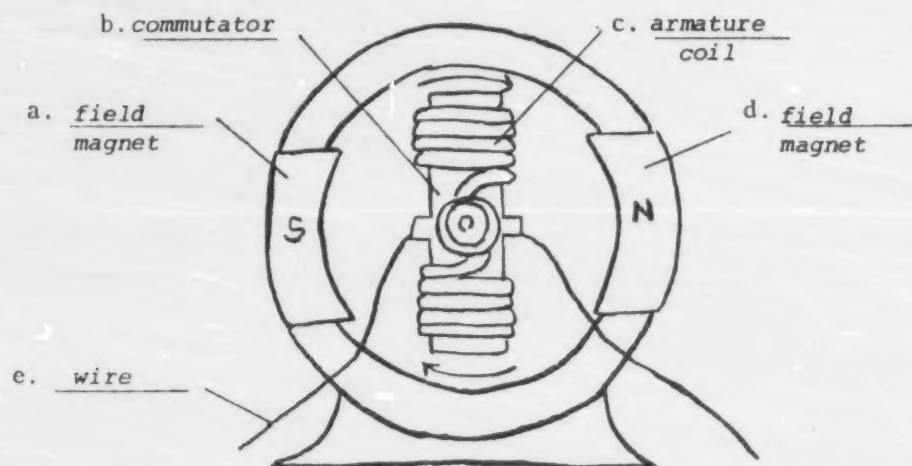
2. Tell how a motor works. Draw picture, to better explain the principle.



Due to the attraction of magnets, the armature of will move in a clock-wise direction. As the magnets pass, the commutator switches the polarity of the armature. Magnetic repulsion will continue to move the armature in a similar manner. As the armature moves back to its original position, the commutator reverses polarity and the cycle begins again.

WORKSHEET

1. Identify the parts of the generator:



2. Why does the generator look like a motor?

A generator looks like a motor because they are built the same way.

3. How does a generator work? How does it compare to a motor?

A generator makes an electric current by moving the armature through the field. This process forces electrons through the wire generating electrical current.

4. TRUE or FALSE. The faster the generator turns-the lower the voltage will be.

WORKSHEET

1. List five reasons why a motor would overheat.

A motor would overheat from:

- | | |
|------------------------|-----------------------------|
| A. Tight brushes | F. Clogged ventilators |
| B. A dragging armature | G. Shorted windings |
| C. Dry bearings | H. Poorly adjusted bearings |
| D. Overload | |
| E. Low line voltage | |

2. List the steps in the general servicing of an electric motor.

Instructor:

Check the service manual for the servicing steps for your motor.

3. If a motor fails to start, what is the first thing you should check?

If a motor fails to start, check to see if it is plugged in and that the fuse is ok.

INDUSTRIAL ELECTRONICS TECHNICIAN

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

At Home with Switches, National Broadcasting Co., Inc., 30 Rockefeller Plaza, New York, N.Y. 10020.

Capacitors, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

Circuit Testing - Signal Generators, U.S. Army, The Pentagon, Washington, D.C. 20310.

Photoconductive Effect, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y. 10020.

Relays, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

Resistors - Color Code, U.S. Air Force, The Pentagon, Washington, D.C., 20330.

Resistors - Construction, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

Semi-Conductors, Bray Studios, Inc., 630 Ninth Avenue, New York, N.Y., 10036.

Series-Parallel Resistive Circuits - Circuit Analysis, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

Use of the Oscilloscope, U.S. Air Force, The Pentagon, Washington, D.C., 20330.

Use of Voltmeter, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

Vacuum Tubes, Encyclopedia Britannica Films.

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Driscoll, Edward F. Industrial Electronics-Devices, Circuits, and Applications. Chicago: American Technical Society, 1979.

Electronic Technician in Industry. Olympic: Coordinating Council for Occupational Education, 1970.

Graham, Kennard C. Industrial and Commercial Wiring. Chicago: American Technical Society, 1979.

Heath, Larry and Winn, Charles S. Exploring Occupations in Electricity and Electronics. New York: Gregg Division McGraw-Hill Book Company, 1976.

Industrial Electronics. Columbus: State Department of Education, 1973.

Lurch, E. Norman. Fundamentals of Electronics. New York: John Wiley & Sons, Inc., 1960.

Marcus, Abraham. Automatic Industrial Controls. Englewood Cliffs: Prentice-Hall, Inc., 1966.

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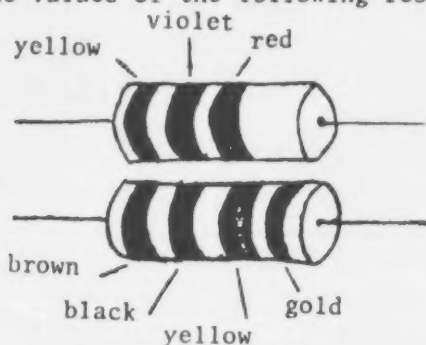
- _____. Basic Electronics, Vol. 3. New York: John F. Rider Publisher, Inc., 1955.
- _____. Basic Electronics, Vol. 4. New York: John F. Rider Publisher, Inc., 1955.
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- _____. Basic Electronics, Vol. 6. New York: John F. Rider Publisher, Inc., 1955.
- Williams, Gerald E. Electricity and Electronics. Chicago: American Technical Society, 1979.

III. EQUIPMENT AND SUPPLIES

VOM
 Oscilloscope
 AC power supply
 Audio signal generator
 Resistors, assorted
 Capacitors, assorted
 Electron tubes, assorted
 Diodes, assorted
 Transistors, assorted
 Wire, insulated
 Solder
 Soldering gun
 Alligator clips
 Alligator test leads
 Phototubes, assorted
 Photovoltaic cells, assorted
 Photoconductive cells, assorted
 Electric counters, assorted
 Binary electronic counters, assorted
 Decade electronic counters, assorted
 Clock timers, assorted
 Electronic time-delay relays, assorted
 Time-interval counters, assorted
 Electrical switches, assorted
 Electromagnetic relays, assorted
 Electronic relays, assorted

WORKSHEET

1. Read the values of the following resistors:

a. resistance 4700 ohmsb. tolerance 20%a. resistance 100 K ohmsb. tolerance 5%

2. Solve the following problems for resistor wattage ratings:

- a. Current flowing through a resistor measures .2 amperes at 10 volts. What should the wattage rating of the resistor be? 50 ohms
- b. A resistor has a rating of 20,000 ohms. 100 volts of electricity is applied across the resistor. What should the wattage rating of the resistor be? .5 watt (1/2 watt)

3. Identify the following:

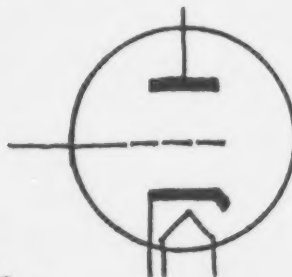
a. type electrolyticb. capacitance 5 MFDc. voltage 150 WVDCa. type ceramicb. capacitance .1 MFDc. voltage 75 volts DC

WORKSHEET

1. Identify the following types of electron tubes:

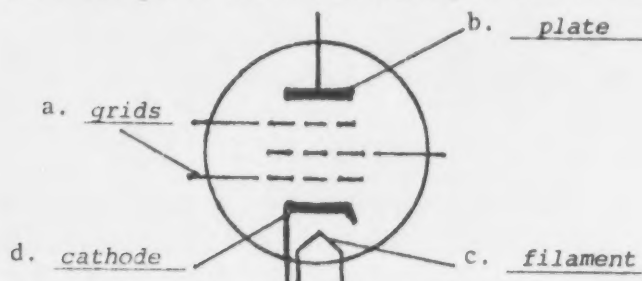


a. tetrode



b. triode

2. Name the parts of the following electron tube:



3. Describe what the filament does in an electron tube.

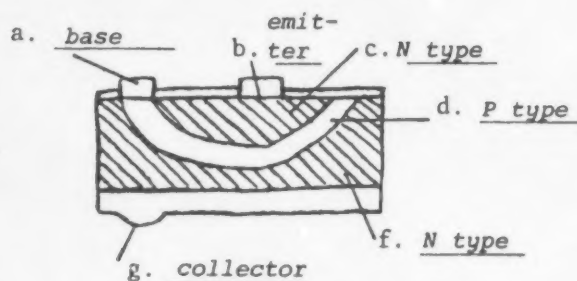
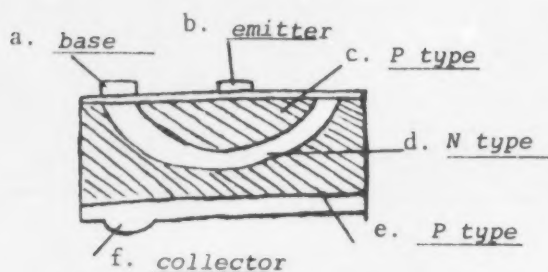
The filament serves to heat the cathode and enhance the emission of electrons from its surface.

4. Look in a tube manual and tell what type of tube a 12AX7 is. What is its filament voltage?

The 12AX7 is a pentode tube having a filament voltage of 12 volts AC.

WORKSHEET

1. In the following drawings, identify the parts of the two kinds of basic transistors:



2. Tell the role of the following transistor parts:

emitter: Emits electron

base: Controls electron flow

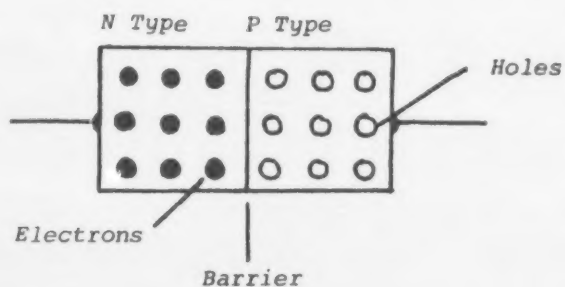
collector: Collects electrons

3. Name the two basic kinds of transistors.

Transistors are of two basic kinds:

- A. NPN
- B. PNP

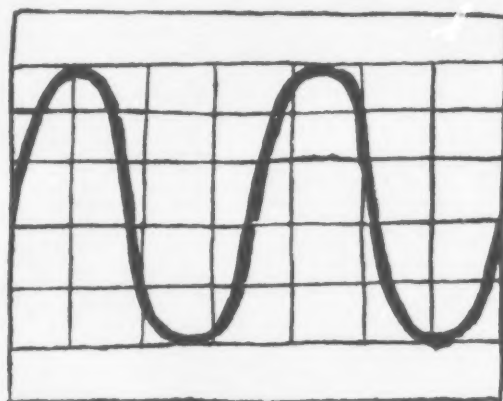
4. Draw a diode and explain how it works.



The diode is an electronic valve. Current can flow from its cathode to its anode, but not in reverse.

WORKSHEET

1. What does the following waveform tell you about the voltage being tested with an oscilloscope?



This waveform tells that the voltage being tested is AC.

2. If an audio signal generator was set at X10 on the frequency range control and the tuning pointer was adjusted to 50 cycles, what frequency would be produced?

500 cycles

3. What is each scale of the VOM used for?

There are three scales on a typical VOM:

- a. DC voltage, AC voltage and current in milliamperes*
- b. Resistance in ohms*
- c. AC voltage of less than 15 volts*

4. If a VOM was set at R x 10K on the range control and the meter needle pointed to 30 on the resistance scale, what would the rating be of resistor being tested?

300 K ohms

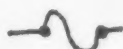
5. TRUE or FALSE. VOM stands for voltage operating meter.

WORKSHEET

1. Identify these schematic symbols:



a. NPN
Transistor



b. fuse



c. diode



d. resistor



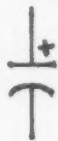
e. chassis



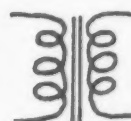
f. battery



g. capacitor



h. electro-
lytic
capacitor



i. transformer

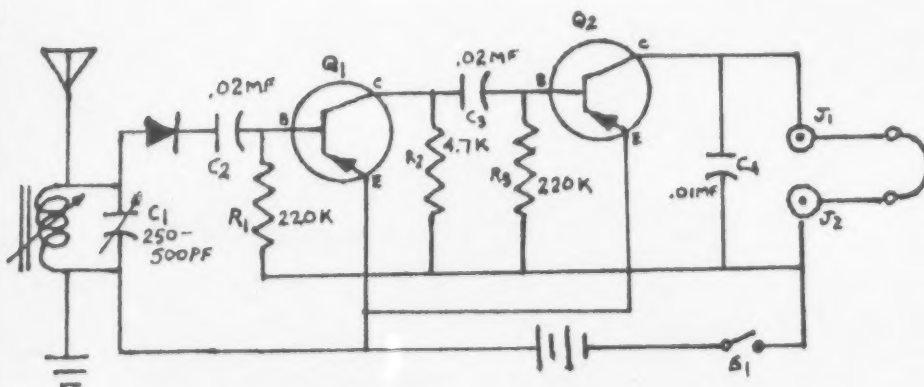


j. speaker

2. List the rules for drawing schematics.

- A. The position of a symbol does not affect its meaning.
- B. The weight of a line does not affect its meaning.
- C. All symbols should be drawn in like proportion.
- D. Symbol size can vary for emphasis.
- E. Connecting lines should be vertical or horizontal.
- F. Arrowheads can be open or closed.
- G. A terminal symbol may be added to any symbol.

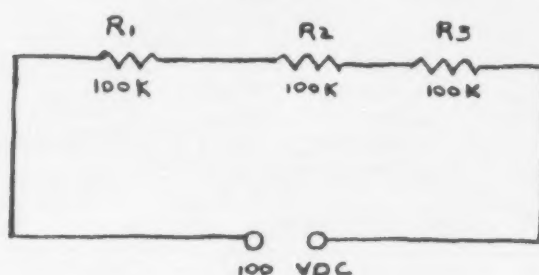
3. Look at the schematic diagram and identify the following:



- a. What component is shown at C_4 ? .001 MFD Capacitor
- b. What is the value of R_2 ? 4.7 K ohm
- c. At Q_1 , what does the letter B mean? base
- d. What is the value of C_1 ? 230-500 PFD.

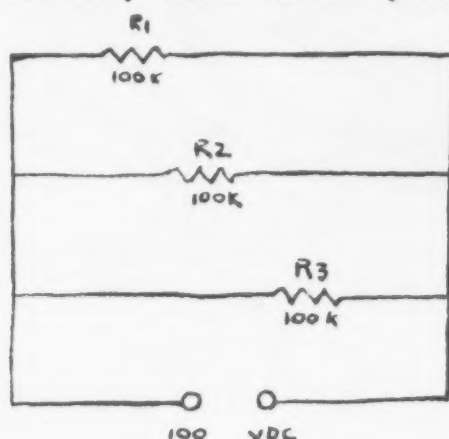
WORKSHEET

1. Solve the problems for this series circuit:



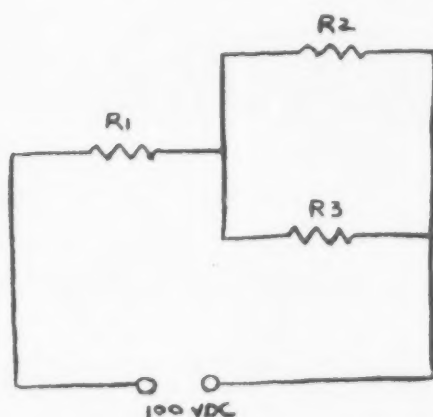
- What is the voltage drop at R_1 ? 33.3 volts
- What is the current at R_2 ? .0003 amps
- What is the total resistance of the circuit? 300 K ohms

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? 100 volts
- What is the current at R_2 ? .001 amps
- What is the total resistance of the circuit? 33.3 K ohms
- What is the total current flow of the circuit? .003 amps

3. Solve the problems for this series - parallel circuit:



- What is the voltage drop at R_1 ? 66.6 volts
- What is the voltage drop at R_2 ? 33.3 volts
- What is the current at R_3 ? .0003 amps
- What is the total resistance of the circuit? 150 K ohms

WORKSHEET

1. Identify these schematic symbols:



a. photovoltaic
cell

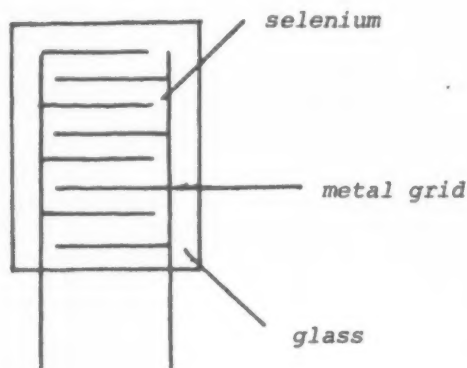
b. photocon-
ductive cell

c. gas filled
photo tube

2. Compare the operation of photovoltaic and photoconductive cells.

A photovoltaic cell produces an electrical current in the presence of light. A photoconductive cell changes resistance in the presence of light.

3. Draw a selenium cell and identify its parts.



WORKSHEET

1. Name five places where counters are used.

- | | |
|---------------------|---------------------|
| A. assembly lines | E. cutting machines |
| B. printing presses | F. etc. |
| C. automobiles | |
| D. ticket gates | |

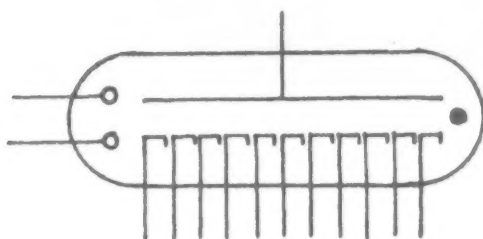
2. Name and describe three electric counter actuators.

- A. *Sensitive* - operates as it is struck by objects.
- B. *Rotary Motion* - operates as object revolves (usually once per revolution).
- C. *Lineal Measuring* - operates by actuator wheels resting on moving material. After so much material passes, the switch is activated.

3. Describe the operation of a simple flip-flop binary counter.

The flip-flop binary counter is designed to count faster than normal mechanical or electrical counters. Its circuit has two stable states - one with half conducting and half non-conducting, and vice versa. The first input flips the circuit from one state to another. The second flops it back. The effect is that the speed of counting is doubled.

4. Draw the schematic symbol for a decade electronic counter.



WORKSHEET

1. Explain how the speed of a bullet is measured.

The bullet is fired in a path which will cut through two light beams focused on two phototubes placed several feet apart. As the bullet passes the first light beam, an electrical pulse starts a time-interval counter. As the bullet passes the second beam, the counter is turned off. A comparison of the elapsed cycles of crystal oscillation will indicate speed.

2. Tell how an electronic time-delay relay operates.

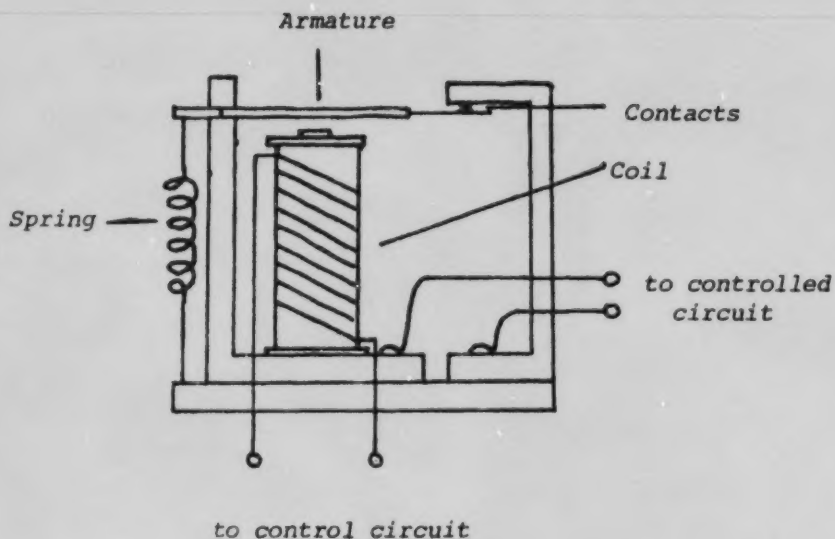
An electronic time-delay relay allows a delayed reaction to occur after a definite amount of time has elapsed. The amount of time delay is regulated by the values of resistance and capacitance across the grid of the control tube (or transistor).

3. Name five timers and tell where they are used.

- A. Interval Timer - used to operate equipment for a definite period of time.
- B. Time-Delay Timer - used to operate a piece of equipment after a time delay and allow it to run for a definite period.
- C. Recycling Timer - operates like the time-delay timer but continuously resets itself and repeats the cycle.
- D. Time Switch - operates equipment at a particular time of the day or night.
- E. Running Time Meter - records the running time of a piece of equipment.

WORKSHEET

1. Draw an electromagnetic relay, label its parts and describe its operation.



The electromagnetic relay operates when current is applied to the coil. The magnetism thus produced causes the armature to move and open or close a switch (by design). The switch so operated allows a controlled circuit to respond.

2. List five different types of switches.

Different switch types include:

- | | |
|----------------|----------------|
| A. knife | F. snap-acting |
| B. toggle | G. limit |
| C. slide | H. rotary |
| D. mercury | I. drum |
| E. push button | J. pressure |
| | K. thermal |

3. Name and describe three main types of electronic relays.

1. *Electronic Contact Relays* - operates similar to other relays but uses a tube to control current to electromagnet.
2. *A-C Electronic Time-Delay Relays* - operates similar to other time-delay relays but uses a tube to control operation.
3. *Photoelectric Relays* - uses a photoelectric cell to control relay.

RADIO AND TV REPAIRER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- Basic Radio Circuitry, Universal Education and Visual Arts, 100 Universal City Plaza, Universal City, Calif. 91608.
- Capacitors, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Circuit Testing - Signal Generators, U.S. Army, The Pentagon, Washington, D.C. 20310.
- Circuit Testing with Meters and Multimeters, U.S. Army, The Pentagon, Washington, D.C. 20310.
- Design Factors in Power Supplies, Assoc. Instructional Material, 600 Madison Ave., New York, N.Y. 10022.
- How Television Works, United World Films, Inc., 221 Park Ave. S., New York, New York 10003.
- Power Supplies, Pt. 1, Assoc. Instructional Materials, 600 Madison Ave., New York, N.Y. 10022.
- Resistors - Color Code, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Resistors - Construction, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Series-Parallel Resistive Circuits - Circuit Analysis, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Television Receivers, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y. 10020.
- The Transistor, Phillips Broadcast Equipment Corp., 1 Phillips Dr., Montvale, N.J. 07645.
- Use of the Oscilloscope, U.S. Air Force, The Pentagon, Washington, D.C. 20330.
- Use of Voltmeter, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

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III. EQUIPMENT AND SUPPLIES

VOM meter
 Oscilloscope
 Audio-signal generator
 Power supply
 Screwdriver assortment
 Resistors, assorted
 Capacitors, assorted
 Transistors, assorted
 Alligator leads
 Solder
 Soldering gun
 Power transformers
 Rectifiers
 Electrolytic capacitors
 Filter coils
 Insulated wire, assorted
 AM radio demonstrator
 Black and white TV demonstrator

WORKSHEET

1. Give the number value for the following resistor code colors:

4 Yellow

0 Black

1 Brown

2 Red

5 Green

8 Gray

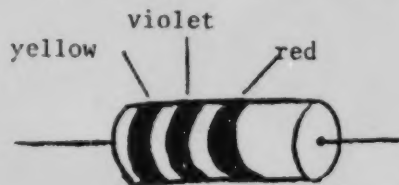
9 White

6 Blue

7 Violet

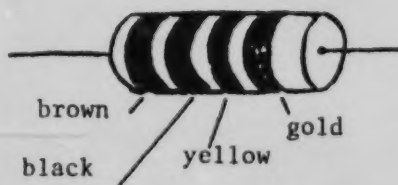
3 Orange

2. Read the values of the following resistors:



a. resistance 4700 ohms

b. tolerance 20%



a. resistance 100K ohms

b. tolerance 5%

3. Solve the following problems for resistor wattage ratings:

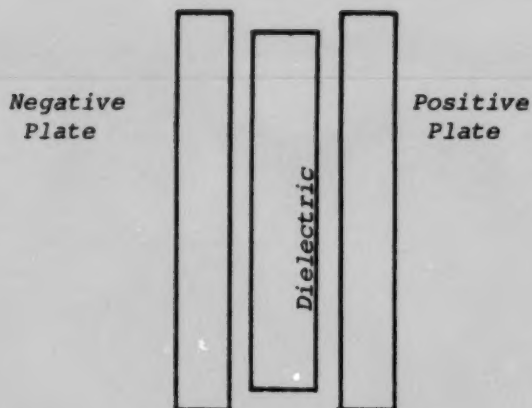
a. Current flowing through a resistor measures .2 amperes at 10 volts. What should the wattage rating of the resistor be? 50 ohms

b. A resistor has a rating of 20,000 ohms. 100 volts of electricity is applied across the resistor. What should the wattage rating of the resistor be? .5 Watt (1/2 Watt)

4. TRUE or FALSE. Resistors are made in different wattage sizes so they can fit in a circuit easily.

WORKSHEET

1. Draw a picture of a simple capacitor and tell how it operates.



A capacitor has no charge when the electrical circuit is open. When the switch is closed, however, electrons flow from the positive plate through the circuit and onto the negative plate. After the capacitor is charged, it holds electrons like a battery and can be discharged when it is connected to a circuit.

2. TRUE or FALSE. A capacitor is rated in farads.

3. What is a capacitor used for?

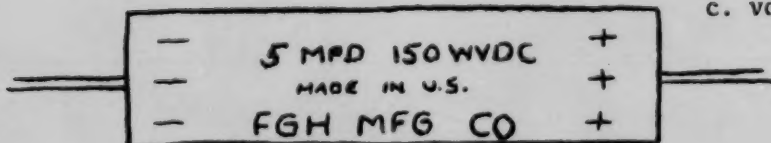
A capacitor is an electrical storage tank which aids in the operation of some electronic devices.

4. Name the two ratings of capacitors.

The two ratings of capacitors are capacitance and voltage rating.

5. Identify the following:

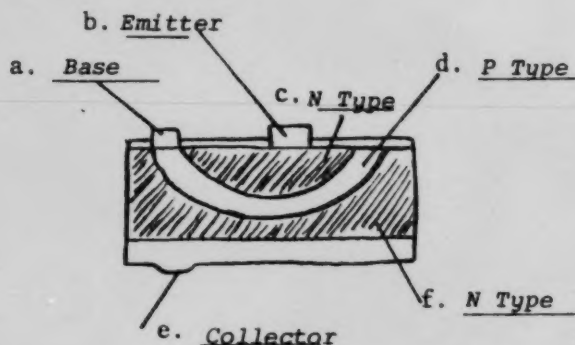
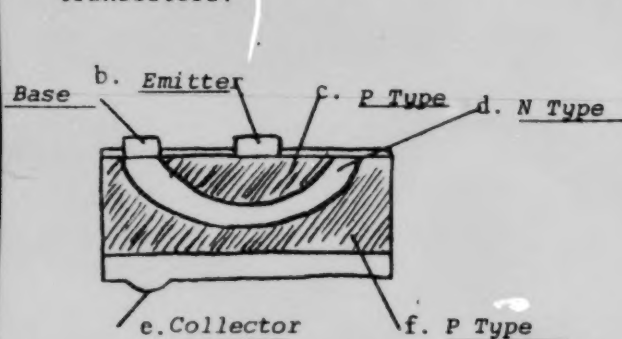
- a. type Electrolytic
 b. capacitance 5 MFD
 c. voltage 150 Volts DC



- a. type Ceramic
 b. capacitance .1 MFD
 c. voltage 75 Volts DC

WORKSHEET

1. In the following drawings, identify the parts of the two kinds of basic transistors.



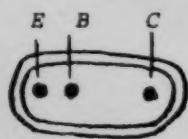
2. Tell the role of the following transistor parts:

emitter: emits electrons

base: controls electron flow

collector: collects electrons

3. Identify the electrodes in the following base pin layouts:



a. _____



b. _____



c. _____

4. Explain how a transistor works.

The transistor operates like a water pipe as electrons flow from the emitter through the base to the collector. The base works like a valve to control the flow of electrons (water).

5. TRUE or FALSE. The transistor can provide voltage gain, current gain and power gain.

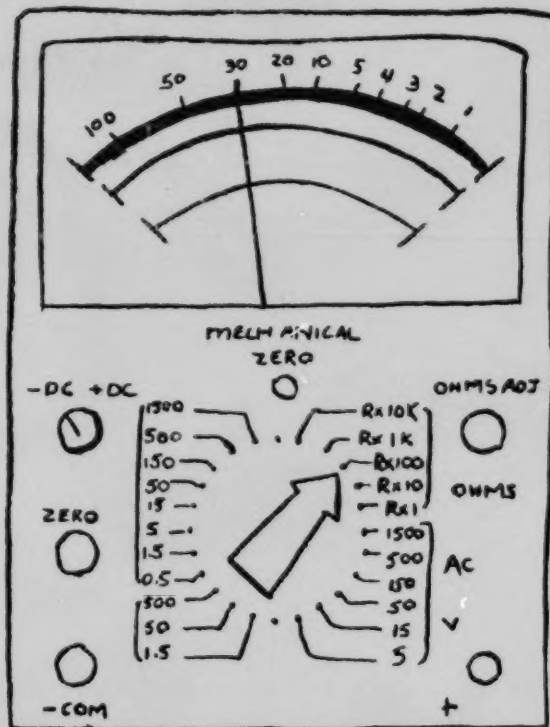
WORKSHEET

1. What is each scale of the VOM used for?

There are three scales on a typical VOM:

- A. DC voltage, AC voltage and current in milliamperes.
- B. Resistance in ohms.
- C. AC voltage of less than 15 volts.

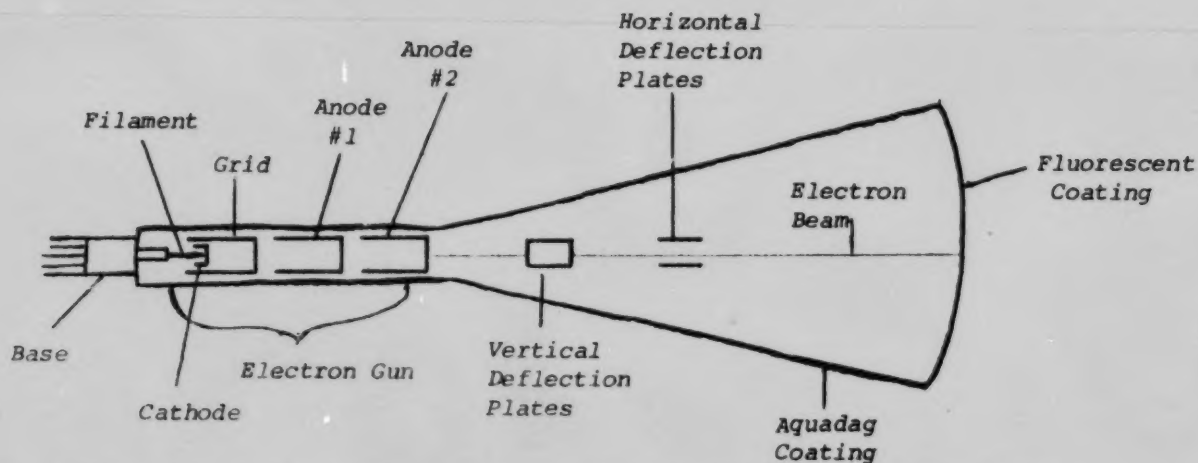
2. TRUE or FALSE. The electronic type VOM which uses vacuum tubes is called VTVM.
3. Look at the following meter and tell what the needle reads:



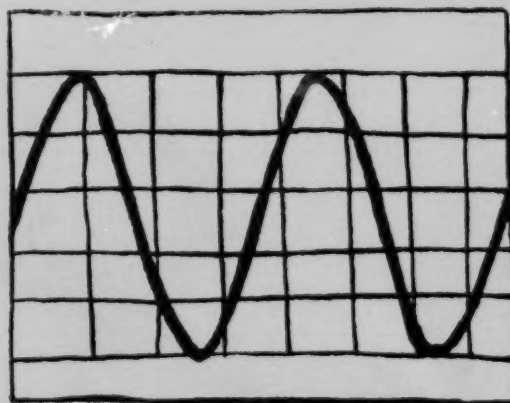
3000 ohms

WORKSHEET

1. Draw and identify the parts of the following cathode-ray tube:



2. What does the following waveform tell you about the voltage being tested with an oscilloscope?



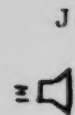
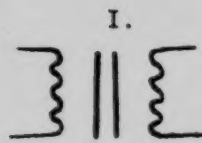
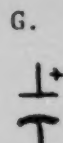
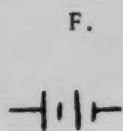
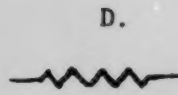
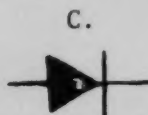
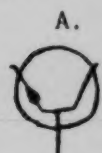
This waveform tells that the voltage being tested is AC.

3. If an audio signal generator was set at X10 on the frequency range control and the tuning pointer was adjusted to 50 cycles, what frequency would be produced?
500 cycles
4. What is the function of a audio signal generator?

The function of an audio signal generator is to produce a continuous signal output ranging from 20 cycles to 1 megacycles.

WORKSHEET

1. Identify these schematic symbols:

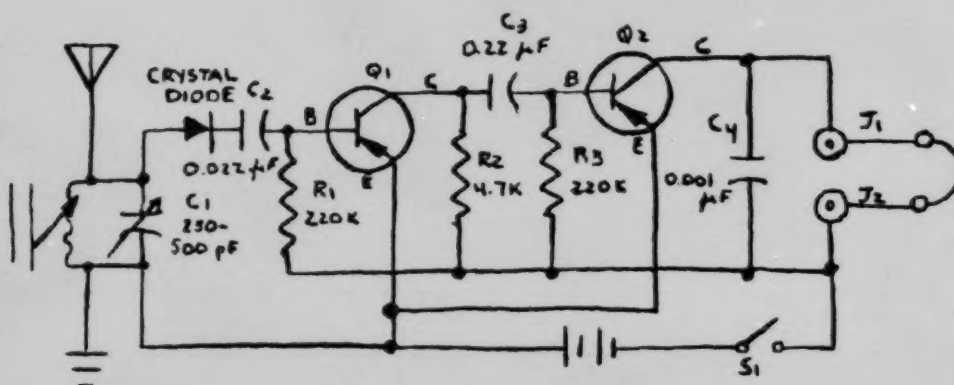


- a. NPN b. Fuse c. Diode d. Resistor e. Chassis
Transistor
 f. Battery g. Electro- h. Capacitor i. Transformer j. Speaker
lytic Capacitor

2. List the rules for drawing schematics.

- The position of a symbol does not affect its meaning.
- The weight of a line does not affect its meaning.
- All symbols should be drawn in like proportion.
- Symbol size can vary for emphasis.
- Connecting lines should be vertical or horizontal.
- Arrow heads can be open or closed.
- A terminal symbol may be added to any symbol.

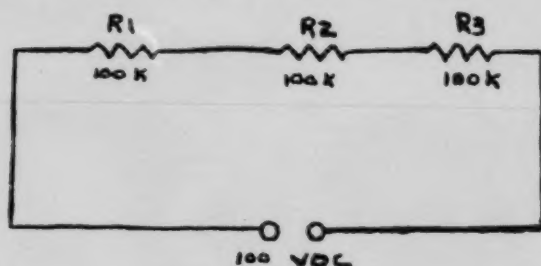
3. Look at the schematic diagram and identify the following:



- What component is shown at C_4 ? 0.001 MFD Capacitor
- What is the value of R_2 ? 4.7 K ohm
- At Q_1 , what does the letter B mean? Base
- What is the value of C_1 ? 230-500 pfd

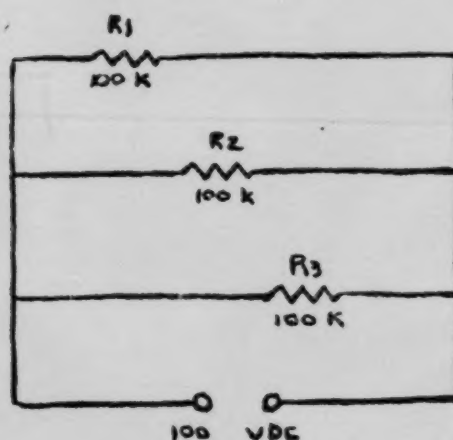
WORKSHEET

1. Solve the problems for this series circuit:



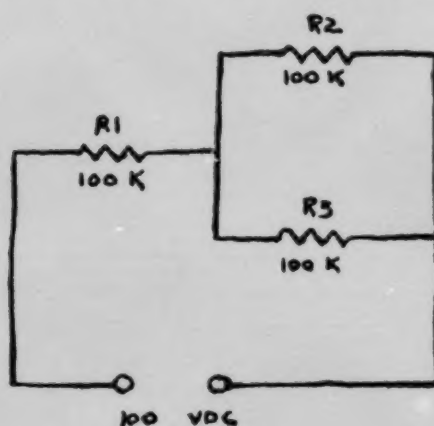
- What is the voltage drop at R_1 ? 33.3 volts
- What is the current at R_2 ? .0003 amps
- What is the total resistance at the circuit? 300 K ohms

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? 100 volts
- What is the current at R_2 ? .001 amps
- What is the total resistance at the circuit? 33.3 K ohms
- What is the total current flow of the circuit? .003 amps

3. Solve the problems for this series-parallel circuit:



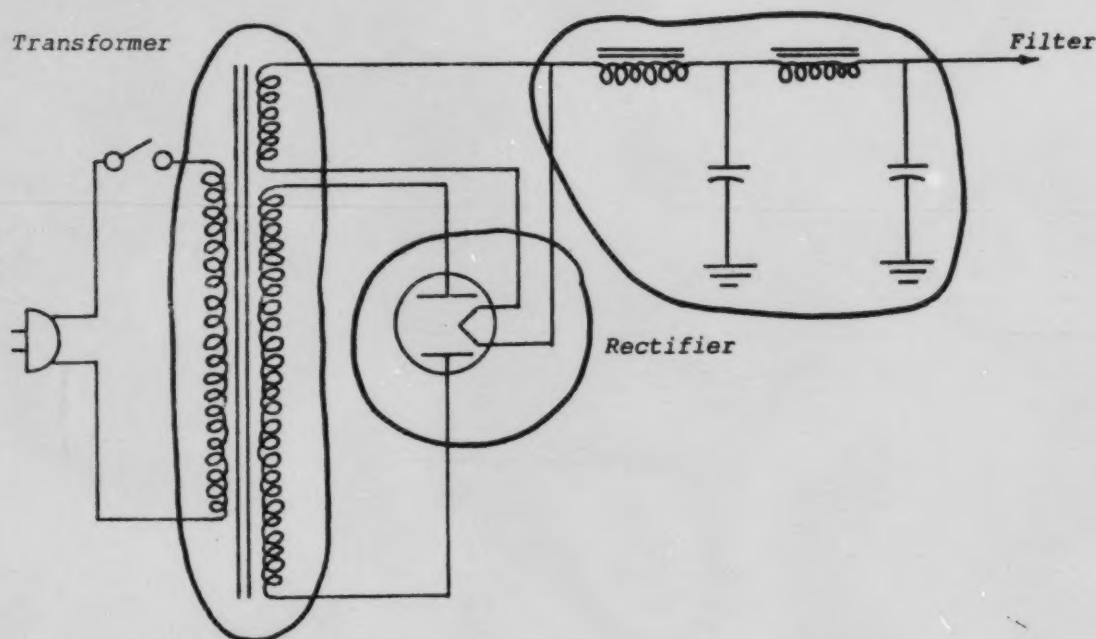
- What is the voltage drop at R_1 ? 66.6 volts
- What is the voltage drop at R_2 ? 33.3 volts
- What is the current at R_3 ? .0003 amps
- What is the total resistance of the circuit? 150 K ohms

WORKSHEET

1. What does a power supply do?

In electronics, a power supply is a circuit or device that changes the primary electric power into the kind & amount of AC or DC needed by different types of electronic circuits.

2. In this schematic diagram, circle the transformer, the rectifier and the filter.

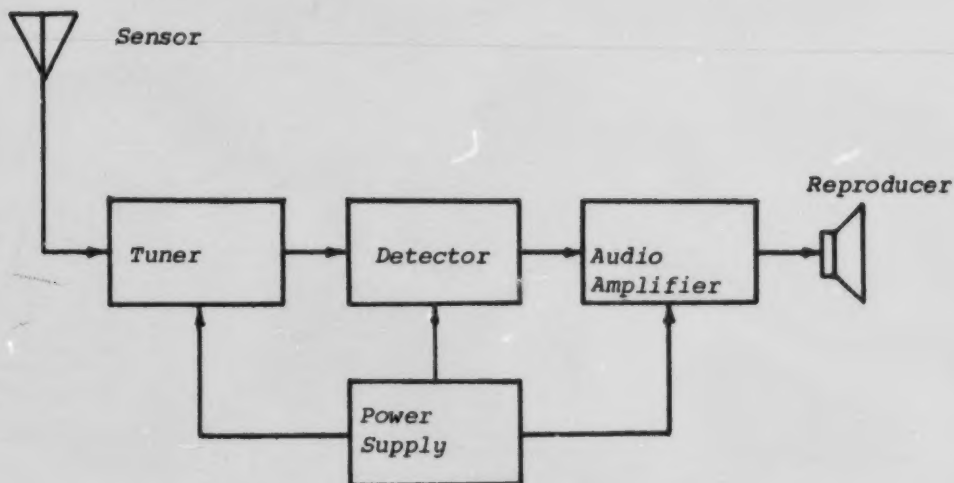


3. In a power supply, what is the function of the transformer, the rectifier and the filter?

- A. Transformers take an AC voltage and increase it or decrease it depending upon the number of turns in the various windings.
- B. Rectifiers change high voltage AC coming out of the transformer into high voltage DC.
- C. Filters smooth out the pulsations of the voltage coming out of the rectifier.

WORKSHEET

1. Draw a block diagram of the basic circuits of the AM Radio and identify each.



2. Identify the function of the following circuits:

sensor - used to carry the energy from a modulated radio wave into a receiver

tuner - used to select a desired radio station

detector - used to separate speech and music from modulated radio waves

amplifier - used to increase volume of received signal

reproducer - used to provide an audible sound

power supply - used to provide power to the various circuits of the AM Radio

3. TRUE or FALSE. The AM in radio circuitry means "Antenna modified."

WORKSHEET

1. Name each of the nine basic circuits in a black and white television receiver and explain their function.

- A. Tuner and R-F Amplifier - produces signal for I-F amplifier
- B. Video Amplifier - forms picture on tube
- C. Noise Gate - filters noise from signals
- D. Automatic Gain Control - controls gain
- E. Sync Limiter - aids in synchronizing horiz and vert deflection
- F. Sound Detector and Amplifier - produces sound
- G. Vertical Output - aids video output
- H. Horizontal Output - aids video output
- I. Low-Voltage Power Supply - supplies power to various circuits

2. Draw a block diagram of a typical black and white television receiver.

See page 419 in Technical Electricity and Electronics

COMMERCIAL ELECTRICIAN

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- At Home with Switches, National Broadcasting Co., Inc., 30 Rockefeller Plaza, New York, N.Y. 10020.
- Electricity - Distribution, Indiana University, Audio-Visual Center, Bloomington, Ind. 47401.
- Electricity - Principles of Safety, Coronet Instructional Films, 65 E. South Water St., Chicago, Ill. 60601.
- Electricity - Wires in Your House, Charles Cahill and Assoc., Inc., P.O. Box 1010, Hollywood, Calif. 90028.
- Roughing-In Nonmetallic Sheathed Cable, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.

II. BOOKS

- Advanced Wiring. Alexandria: Time-Life Books, 1978.
- Alerich, Walter N. Electrical Construction Wiring. Chicago: American Technical Society, 1979.
- Foth, Lawrence. Electrical Systems. Topeka: Kansas State Department of Education, 1971.
- Graham, Kennard C. Industrial and Commercial Wiring. Chicago: American Technical Society, 1979.
- Heath, Larry and Winn, Charles S. Exploring Occupations in Electricity and Electronics. New York: Gregg Division McGraw-Hill Book Company, 1976.
- Herrick, Clyde N. Electrical Wiring & Principles and Practices. Englewood Cliffs: Prentice-Hall, Inc., 1975.
- Kaufman, Milton and Wilson, J.A. Basic Electricity Theory and Practice. New York: McGraw-Hill Book Co., 1973.
- Mix, Floyd M. House Wiring Simplified. South Holland: The Goodheart-Willcox Co., Inc., 1973.
- Porter, John Paul Ed. Basic Wiring. New York: Time-Life Books, 1976.
- Smith, Jimmie. Commercial Electrician. Austin: Texas State Department of Education, 1975.
- Van Valkenburgh, Nooger and Neville, Inc. Basic Electricity, Vol. 1. New York and John F. Rider Publisher, Inc., 1954.
- _____. Basic Electricity. Vol. 2. New York: John F. Rider Publisher, Inc., 1954.
- _____. Basic Electricity, Vol. 3. New York: John F. Rider Publisher, Inc., 1954.
- _____. Basic Electricity. Vol. 4. New York: John F. Rider Publisher, Inc., 1954.
- _____. Basic Electricity. Vol. 5. New York: John F. Rider Publisher, Inc., 1954.

III. EQUIPMENT AND SUPPLIES

Electrical wire gage
Wire insulation stripper
Screwdriver assortment
Pliers, regular
Pliers, side cutters
Insulated wire, assorted
Electrical conduit, assorted
SPST switches
Electrical switches, assorted
Light bulbs, assorted
Light bulb sockets
Three-way switches
Electrical receptacles
Fluorescent light fixtures
Flourescent tubes, assorted
Fuses, assorted
Circuit breakers, assorted
Waterproof electrical devices

WORKSHEET

1. Define Watt.

Watt is the rating for electrical power.

2. State the Power Law.

Watts Equals Volts Multiplied by Current

$$P = E \times I$$

3. Using the Power Law, solve the following problems:

- a. How much current is used by a light rated at 12 volts and 20 watts?

1.66 Amps

- b. How much power is used by a radio rated at 120 volts and .1 amperes of current?

12 Watts

- c. What is the voltage rating of a toaster if it consumes 1200 watts of power and uses 10 amperes of current?

120 Volts

4. TRUE or FALSE. A kilowatt is 100 watts.

5. TRUE or FALSE. It would be cheaper to listen to a 10 watt radio for one hour than to listen to a 50 watt stereo tape player for fifteen minutes.

WORKSHEET

1. Tell the relationship between wire size and voltage drop.

Small diameter wire has a higher resistance than large diameter wire. High resistance means high voltage drop, therefore, small diameter wire will have a relatively high voltage drop.

2. Explain the sizes of wires.

Wire size is measured in gauges. A #1 wire is larger in diameter than a #20 wire. Sizes range from #0000 to #40.

3. TURE or FALSE. A No. 10 wire has a higher current rating than a No. 12 wire.

4. TRUE or FALSE. As long as a wire is insulated, it can be used anywhere in the house.

5. Name three types of rigid conduit.

Three types of rigid conduit are:

- A. Thin-Wall
- B. Rigid
- C. PVC-Rigid Plastic

6. List five types of indoor wire insulation and tell about their use.

Indoor insulation types include:

- A. RHW - used with all sizes of wire in wet or dry areas
- B. T - used with all sizes of wire in dry areas
- C. TW - used with all sizes of wire in wet or dry areas
- D. THW - used with all sizes of wire in wet or dry areas
- E. THWN - used with all sizes of wire in wet or dry areas

WORKSHEET

1. In the space provided, identify and layout the electrical service needs for your bedroom at home.

2. TRUE or FALSE. All closets should have an overhead light.

3. Identify the following schematic symbols:



a. Lighting
Outlet



b. Duplex
Outlet



c. 3-Way
Switch



d. Dishwasher
Outlet

WORKSHEET

1. Tell what each of the four basic types of switches are used for.

- A. *Single Pole* - controls a light or outlet from a single position.
- B. *Three Way* - used in pairs to control a light or receptacle from two locations.
- C. *Four Way* - Used with three-way switches to control a light or receptacle from three or more locations.
- D. *Double-Pole* - used to control 240 volt appliances.

2. Identify these switches:

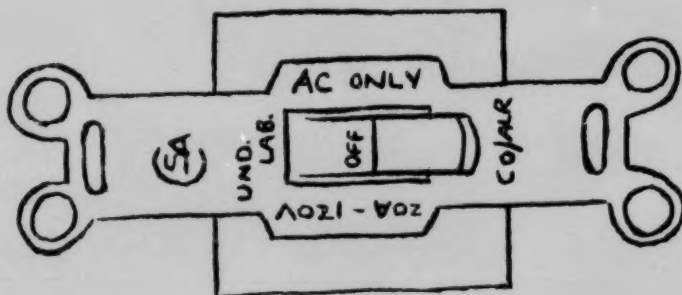


a. Single-Pole



b. Three-Way

3. Tell the ratings of this switch.



Max. current 20 Amps

Voltage 120 Volts

Wire type Aluminum

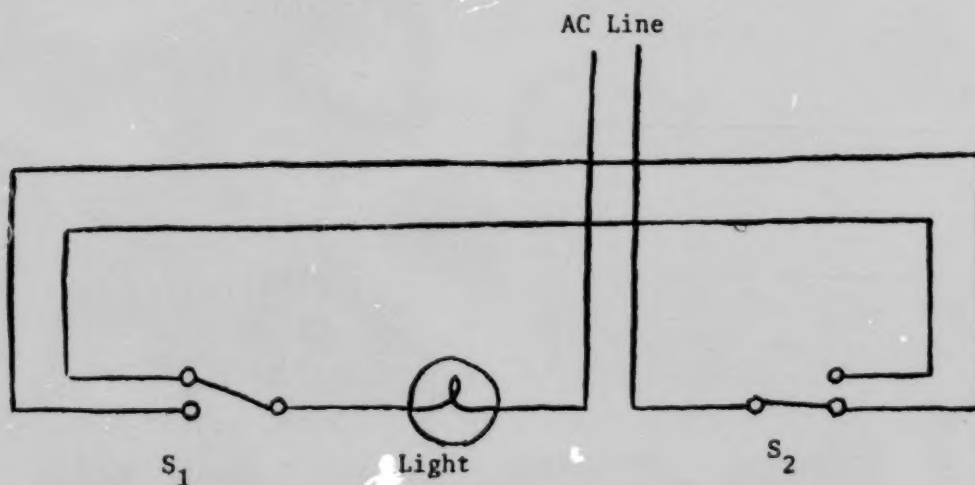
AC or DC AC

WORKSHEET

1. Tell where you would use the following specialized switches:

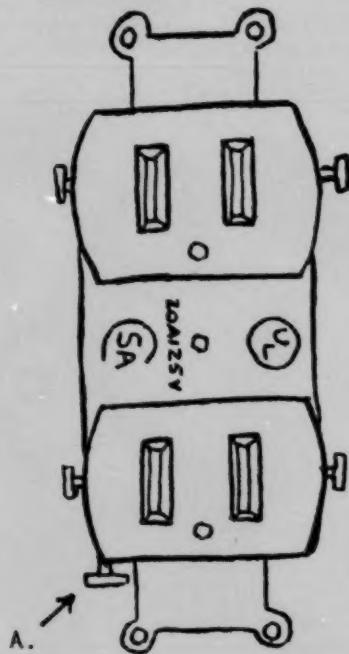
- a. Mercury Switch - usually found in bedrooms or nurseries due to its silent operation.
- b. Dimmer Switch - used to control the intensity of an incandescent or fluorescent light.
- c. Time-Delay Switch - often used in basements, garages or patios to delay the automatic shut-off of lights, etc.
- d. Pilot-Light Switch - found on appliances to indicate that unit is turned on.

2. TRUE or FALSE. The following three-way switch wiring diagram is acceptable.



WORKSHEET

1. Identify the following type of receptacle and its ratings:



- a. type Side Wired
b. current 20 Amps
c. voltage 125 Volts
d. wire type Not Given

2. Tell what the terminal screw is used for located at "A" in the above drawing.

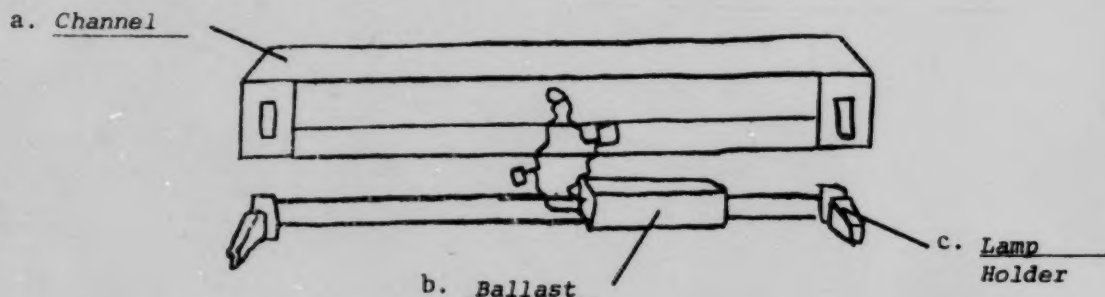
The terminal screw at "A" is a lug for wiring a ground line.

WORKSHEET

1. Tell where each type of fluorescent light fixtures might be found.

Fluorescent light fixtures are of three basic types: straight, circular and "U" shaped. These fixtures are commonly found over workbenches, counters, and desks where high-intensity light is needed. Fluorescent lights are found in bathrooms, kitchens and occasionally in livingrooms to provide indirect lighting.

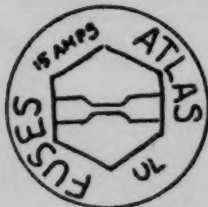
2. TRUE or FALSE. If a fluorescent tube has markings of F15T8/CW, then it is a cool white 15 watt tube.
3. Identify the parts of the following rapid start fixture:



4. Tell what the possible causes are for the following problems in fluorescent fixtures:
- a. tube will not light - fuse blown, tube worn out, dirt on tube, poor contact, incorrect tube for ballast, defective starter
 - b. fixture hums - ballast wires loose or poorly attached, incorrect ballast
 - c. blackening at ends of tube - tube nearly worn out

WORKSHEET

1. Identify the type, rating and use of the following fuse.



- a. Type: Plug
 b. Rating: 15 Amps
 c. Use: General Household
Circuitry

2. Tell how a circuit breaker operates.

A circuit breaker operates when excess current opens a switch within the circuit breaker. Current flow is stopped, preventing the generation of heat that would start a fire.

The breaker is quickly reset after the cause of failure is corrected and current once again can flow.

3. Tell why it is best to have a motor wired to a circuit breaker than a plug-type fuse.

A motor starting up draws an excess of current till it reaches its correct RPM and then reduces its consumption. A circuit breaker has the capacity to carry an overload of current for a short period of time. A plug fuse, on the other hand, will blow with any excess of current and, therefore, would not allow the motor to start.

4. TRUE or FALSE. A time-delay fuse will allow you enough time to vacate a building incase of an electrical short circuit.

WORKSHEET

1. Why is it important to have electrical circuits grounded?

An electrical wiring system should include grounding circuits for the protection of people and equipment. Properly grounded circuits reduce shock and fire hazards.

2. Tell how to install a ground rod.

A ground rod can be an 8 foot length of 3/4" galvanized-iron pipe or 1/2" copper rod. The rod must be located at least two feet away from the building and driven one foot below the surface of the soil.

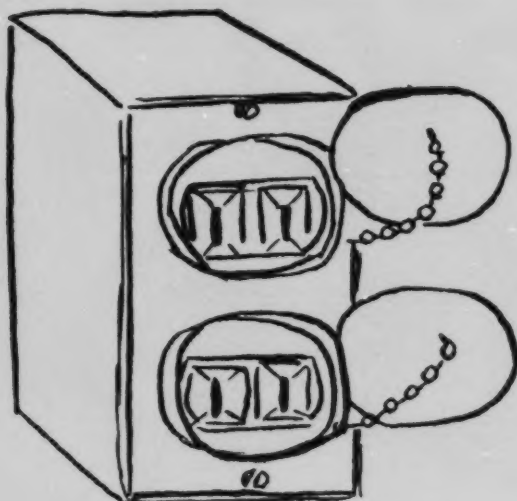
3. Draw sketches showing how to ground a single-pole switch and a receptacle when they are being wired.

INSTRUCTOR:

See Basic Wiring, Pages 43 to 44 and 54 to 55.

WORKSHEET

1. Identify this fixture and describe its use:



This is a weatherproof receptacle. It is used outdoors and is impervious to rain and snow.

2. TRUE or FALSE. Any type of insulated wire can be used outdoors as long as it is in conduit.
3. Explain the purpose of the gasket in weatherproof fixtures.

The purpose of the gasket in a weatherproof switch is to act as a seal to keep moisture from seeping into the electrical connections.

AIR CONDITIONER MECHANIC

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- Heat and Temperature, Coronet Instructional Films, 65 E. South Water St., Chicago, Ill. 60601.
- Let's Talk About Air, Coleman Film Enterprises, Inc., 9101 Barton, Shawnee Mission, Ks. 66214.
- Pressure and Humidity, Charles Cahill and Assoc., Inc., P.O. Box 1010, Hollywood, Calif. 90028.
- Principles of Refrigeration, U.S. Office of Education, 400 Maryland Ave. SW, Washington, D.C. 20202.
- Refrigeration and Air Conditioning, Coronet Instructional Films, 65 E. South Water St., Chicago, Ill. 60601.
- Refrigeration - Compressor Controls, U.S. Navy Department, Office of Information, Pentagon Bldg., Washington, D.C. 20350.
- Refrigeration - Condenser Controls, U.S. Navy Department, Office of Information, Pentagon Bldg., Washington, D.C. 20350.
- Refrigeration - Evaporator Controls, U.S. Navy Department, Office of Information, Pentagon Bldg., Washington, D.C. 20350.
- Refrigeration - Principles of Mechanical Refrigeration, U.S. Air Force, The Pentagon, Washington, D.C. 20330.

II. BOOKS

- Anderson, Edwin P. Air Conditioning. Indianapolis: Theodore Audel & Co., 1971.
- Kirkpatrick, James M. and Weaver, Michael K. Environmental Control - Air Conditioning and Refrigeration Theory and Application. New York: Harper and Row, 1974.
- Langley, B.C. Electric Controls for Refrigeration and Air Conditioning. Englewood Cliffs: Prentice-Hall, Inc., 1974.
- Schweitzer, Gerald and Ebeling, A. Basic Air Conditioning. Rochelle Park: Hayden Book Company, Inc., 1971.
- Trane Air Conditioning Manual. LaCrosse: The Trane Company, 1965.
- Wantiez, Gary W. Air Conditioning and Refrigeration. Stillwater: State Department of Vocational and Technical Education, 1977.

III. EQUIPMENT AND SUPPLIES

- Sling pyrometer
- Thermometers, assorted
- Barometer
- Air conditioner trainers

WORKSHEET

1. What gases make up air?

The main gases which make up air include oxygen, nitrogen, carbon dioxide, carbon monoxide, ozone and neon.

2. Why is air movement an important part of air conditioning?

Air movement is important in airconditioning because:

- A. It carries away the moisture and heat surrounding the body.*
- B. It must be constantly drawn into the conditioner and passed out over the cool evaporator in order for absorbed moisture to be condensed and eliminated.*

3. What things can be used to clean and filter air?

One technique for cleaning air is air washing, though this process does not eliminate carbons, soots, etc. In order to eliminate these substances, a dry or viscous type air filter can be used.

4. TRUE or FALSE. Specific heat is measured with a thermometer.

5. TRUE or FALSE. Latent heat causes a material to change from solid to liquid.

6. State Boyle's Law. Explain what it means.

"At constant temperature, the volume of a given weight of gas varies inversely as the pressure to which it is subjected." or "PXV = pxv"

The law means that if temperature does not change, the volume of a gas will decrease if pressure increases. Conversely, the volume of a gas will increase as pressure decreases.

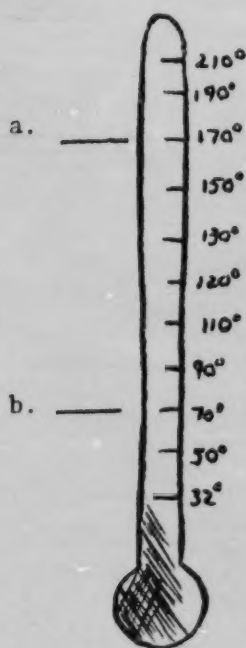
WORKSHEET

1. Define BTU.

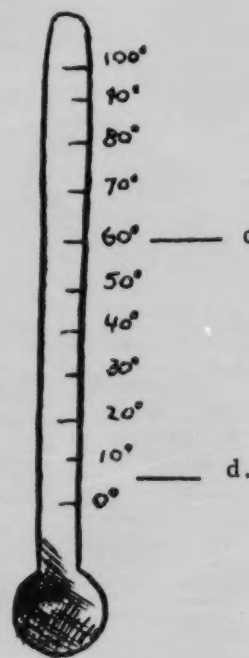
BTU is the British Thermal Unit. It is the amount of heat required to raise the temperature of one pound of pure water at its greatest density one degree Fahrenheit.

2. TRUE or FALSE. Temperature is measured by the height of silver in a thermometer stem.

3. Read the following temperatures:



Centigrade



Fahrenheit

- a. 170°C
 b. 70°C
 c. 60°F
 d. 5°F

4. Convert the following temperatures:

- a. 10 C = 50° F
 b. 45 C = 113° F
 c. 32 F = 0° C
 d. 77 F = 25° C

WORKSHEET

1. Tell where each method of heat transfer is found.

- A. Radiation is a method of heat transfer found in home radiator heaters.
- B. Conduction is a method of heat transfer found in the handle of a hot spoon.
- C. Convection is a method of heat transfer found in central air conditioning systems of the home.

2. MULTIPLE CHOICE. The earth receives heat from the sun by: (a) radiation (b) conduction (c) convection (d) reflection

3. MULTIPLE CHOICE. A pot-bellied stove heats by: (a) reflection (b) radiation (c) convection (d) conduction

4. TRUE or FALSE. Forced - air heating systems transfer heat using the convection principle.

5. Describe how to control each of the three methods of heat transfer.

Radiation can be maximized by constructing the radiating object from a good, dark-colored material. Radiation can be impeded by using a light-colored or shiny material.

Conduction heat flow can be affected by the size and quality of the material used. The flow of heat through convection can be controlled by moving the heat-transferring medium at a faster or slower rate, as required.

6. Since the earth is heated directly by the sun, why isn't the air in the atmosphere hot?

The air in our atmosphere is not heated directly by the sun because in radiation heat transfer only opaque or translucent are heated. Transparent materials absorb very little warmth.

WORKSHEET

1. Define atmospheric pressure.

Atmospheric pressure is the pressure of the air around us. This pressure is 14.7 PSIA at sea level, but varies with altitude.

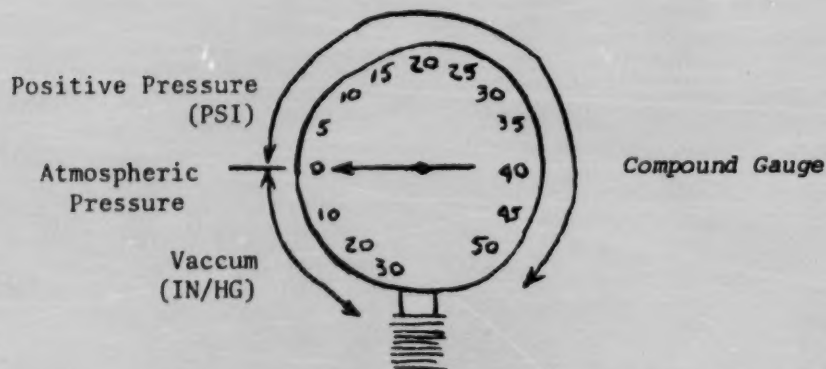
2. Give three examples of pressure gauges.

Examples of pressure gauges include:

- A. Bourdon-type
- B. Compound
- C. Barometer
- D. Manometer

3. TRUE or FALSE. The pressure of three inches of water on the sides of a glass is the same as the pressure of five inches of water.

4. Identify this gauge:



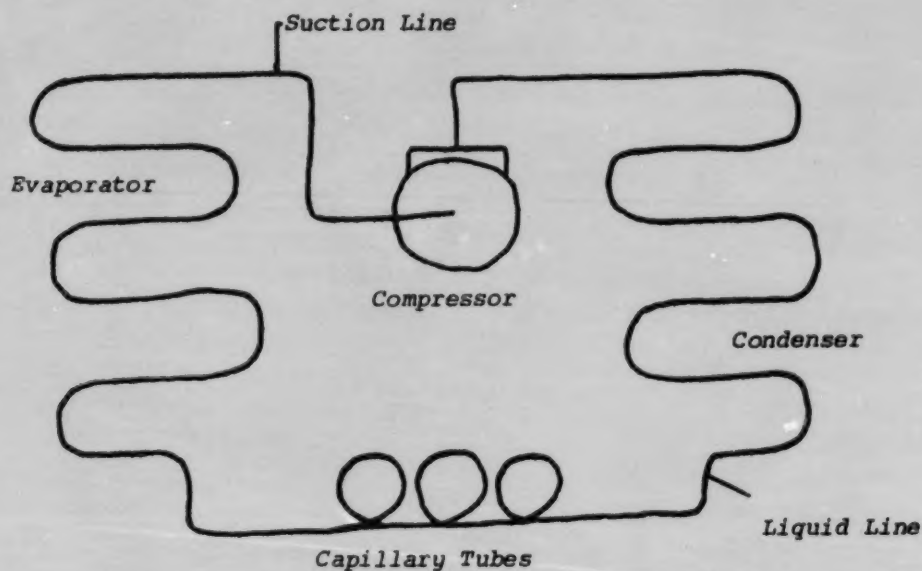
5. TRUE or FALSE. Gas pressure changes with temperature.

WORKSHEET

1. Explain how evaporative cooling works.

Evaporative cooling works by the absorption of heat as the liquid refrigerant turns to vapor.

2. Draw a diagram of the basic compression refrigeration system, identify the parts and tell how it operates.



3. TRUE or FALSE. The refrigerant gives up its absorbed heat in the capillary tube section.
4. TRUE or FALSE. The refrigerant exists as a solid, a liquid and as a gas while in the air conditioner.

WORKSHEET

1. Tell what the refrigerant does in the refrigeration system.

The refrigerant picks up latent heat when it evaporates from a liquid to a gas at a low temperature and pressure. It expels latent heat when it condenses from a gas to a liquid at a high pressure and temperature.

2. Name five common refrigerants.

Five common refrigerants include:

- A. R-11 (Refrigerant 11)*
- B. R-12 (Refrigerant 12)*
- C. R-22 (Refrigerant 22)**
- D. R-717 (Ammonia)*
- E. R-718 (Water)*

3. List the thermodynamic and material properties of refrigerants and tell why they are important.

- | | |
|-------------------------------|-----------------------------------|
| <i>A. Operating Pressure</i> | <i>G. Ability To Mix With Oil</i> |
| <i>B. Boiling Temperature</i> | <i>H. Moisture Reaction</i> |
| <i>C. Specific Volume</i> | <i>I. Odor</i> |
| <i>D. Density</i> | <i>J. Toxicity</i> |
| <i>E. Enthalpy</i> | <i>K. Leakage Tendency</i> |
| <i>F. Flammability</i> | <i>L. Leakage Detection</i> |

4. If the compressor of an air conditioner was very weak and not capable of high compression, which refrigerant would you select for use? Why?

R-11 is the best refrigerant to use when an air conditioner compressor is weak due to its low condensing pressure.

WORKSHEET

1. Tell what the compressor does in the refrigeration system.

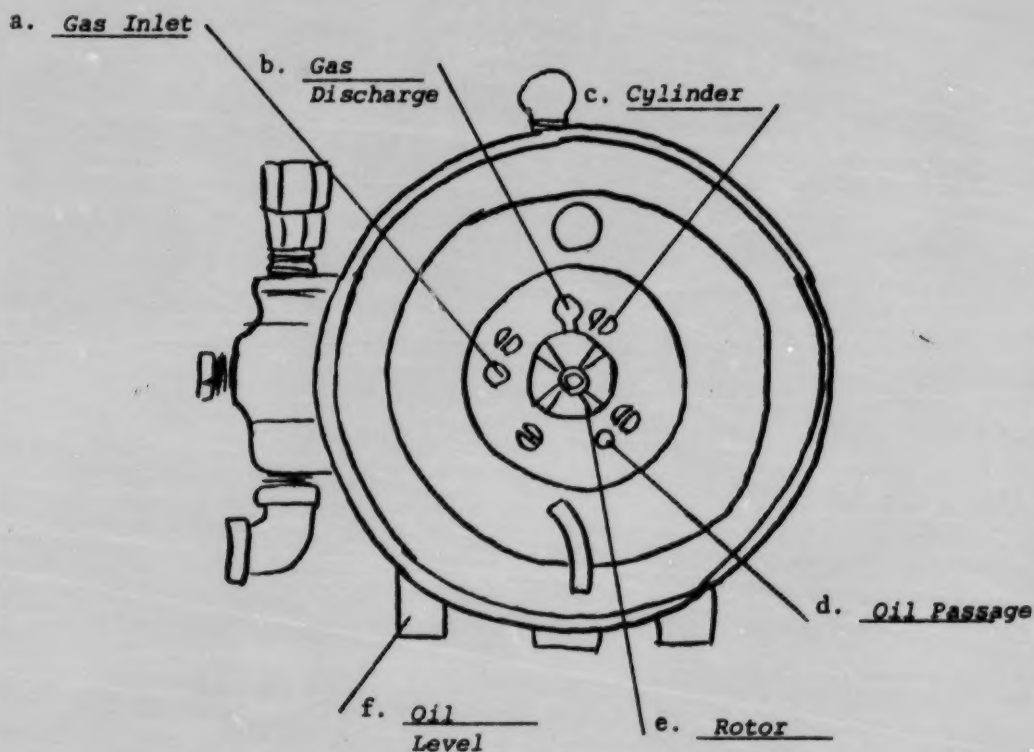
The compressor draws low-pressure, low-temperature gas refrigerant into its cylinder, compresses it to a high-pressure, high-temperature gas and discharges the refrigerant in this state into the condenser, through a discharge valve.

2. Name the three basic compressor types.

The three basic compressor types include:

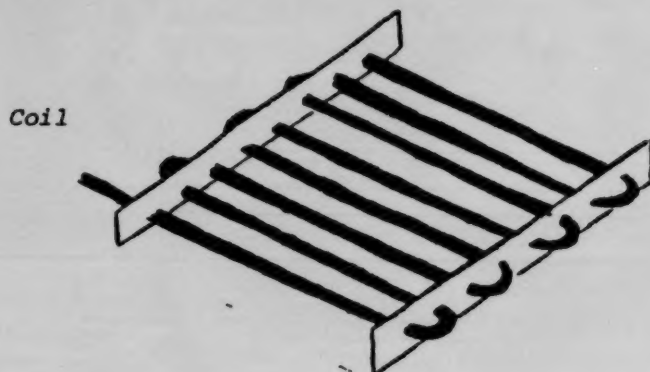
- A. reciprocating
- B. rotary
- C. centrifugal

3. Identify the parts of the Rotary Compressor:



WORKSHEET

1. What type of evaporator construction is shown in the following sketch?



2. Describe the role of the evaporator in the refrigeration system.

The evaporator removes heat from the medium surrounding it, thereby producing a cooling effect.

3. Name the two types of evaporators used in the refrigeration system.

The two types of evaporators are:

- A. Direct-Expansion Type
- B. Flooded Type

4. Name the three ways evaporators are made.

Evaporators are made three ways:

- A. Coil
- B. Fin
- C. Plate

WORKSHEET

1. Outline the role of a condenser in the refrigeration system.

The condenser expels heat from the refrigeration system by allowing the high-temperature, high-pressure vaporized refrigerant to condense and release latent heat.

2. Outline the role of a receiver in the refrigeration system.

The receiver acts as a storage tank for liquid refrigerant as it leaves the condenser and before it enters the metering device.

3. Describe three ways to cool a condenser.

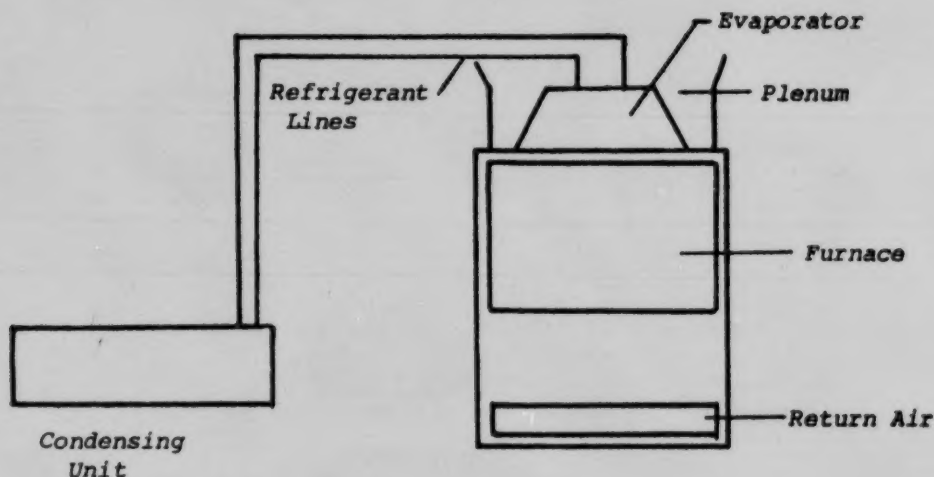
Condensers are cooled in three ways:

- A. Air
- B. Water
- C. Air and Water

4. TRUE or FALSE. A condenser takes cold vaporized refrigerant in and expels hot liquid refrigerant out.

WORKSHEET

1. In the space provided, draw a picture of a central air conditioner system and name the parts.



2. Tell where each of the mechanical components in a cooling system are located and explain how they operate.

The condensing unit sits outside and is linked to the evaporator by the liquid and suction lines. The evaporator, blower, capillary tubes and air filter are located inside.

The compressor starts by thermostat adjustment. The inside blower blows air across the evaporator and cools it. The rest of the operation is a simple refrigeration system.

3. Name three common refrigerants and discuss their properties.

R-12, R-22 and R-500 are three common refrigerants. They are fluorinated hydrocarbons which are noncorrosive, nonflammable, nontoxic, nonexplosive and have a pleasant odor.

4. TRUE or FALSE. Since leaks do occur in air conditioning systems, all refrigerants should be non-toxic and non-flammable.

CUSTODIAN

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

All About Floors, Armstrong Cork Co., Liberty and Charlotte Sts., Lancaster, Pa., 17604.
Damp Mopping, Comprenetics, Inc., 9601 Wilshire, Beverly Hills, Calif. 90210.
DDT in the Control of Household Insects, U.S. Army, The Pentagon, Washington, D.C. 20310.
Dust Mopping, Comprenetics, Inc., 9601 Wilshire, Beverly Hills, Calif. 90210.
Extinguish That Fire, L.A. City Fire Department, Administration Services, Los Angeles, Calif. 90012.
Plumbing - Joints, Sterling Educational Films, 241 E. 34th St., New York, N.Y. 10016.
Ratproofing, U.S. Public Health Service, Welfare Bldg., 4th St. and Independence Ave. SW, Washington, D.C. 20201.
Restroom Cleaning Procedures, Comprenetics, Inc., 9601 Wilshire, Beverly Hills, Calif. 90210.
Wood Finishing, Young America Films, McGraw-Hill Publishing Co., New York, N.Y. 10020.

II. BOOKS

Custodial Trainer's Manual. Charleston: West Virginia Department of Education, 1974.
 Herschbach, Dennis R. Custodial Services Series. Baltimore: Maryland Department of Education, 1978.
Janitor. Charleston: West Virginia State Department of Education, 1978.

III. EQUIPMENT AND SUPPLIES

Flooring samples
 Commercial dust mop
 Dust pan/brush
 Commercial wet mop
 Wringer bucket
 Commercial floor scrubbing machine w/brush asst.
 Assortment window cleaning tools
 Electric power sander, belt
 Electric power sander, oscillating
 Lavatory brush assortment
 Assortment plumbers tools
 Hacksaw
 Steel rule
 Insulation wire stripper

Screwdriver assortment
Rubber water hose
Litter stick
Riding lawn mower
Push power mower
Lawn care spreader
Hedge trimmer
Pruning shears
Dust mop treatment solution
Cleaning solution
Liquid wax
Sponge and squeegee
Mouse traps
Fertilizer
Electric light bulbs
Plastic pipe
Vise
Pipe wrench
Plunger
Scrub brushes
Bucket
Ladders, assorted
Window cleaner
Abrasive paper, assorted
Rags
Wood finish
Solvent
Paint brushes
Trash bags
Sponges
Gloves
Putty knife

WORKSHEET

1. Define Resilient Flooring.

Resilient flooring is soft flooring which will recover from dents and stress. Examples include asphalt tile, rubber tile, vinyl tile and linoleum.

2. Of all soft flooring, which is used most often in new buildings?

Vinyl tile is the type of soft flooring which is most often used in new buildings.

3. List three different woods used in wood floors.

Different woods used in wood floors are:

oak, maple, beech, pecan, birch, pine, fir, and hemlock

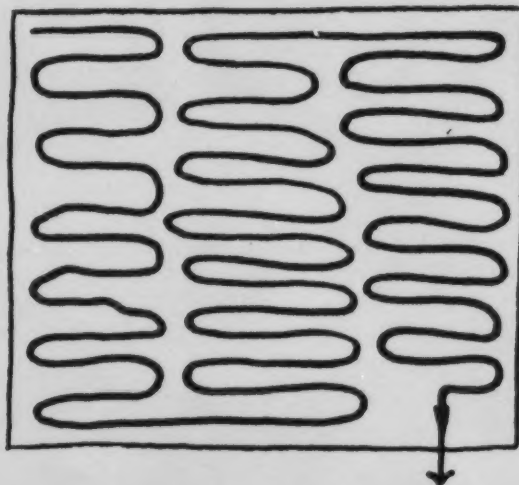
4. On which floors would you not use turpentine as a cleaner?

Never use turpentine on a rubber tile floor.

5. List three types of equipment used in wet mopping.

Types of equipment used in wet mopping include a wet mop, buckets with wringers and cleaning solutions.

6. Pretend this square is a room. Show with your pencil the path you would take to wet mop the floor.



WORKSHEET

1. Explain the following terms:

- a. Buffing - The process of polishing a waxed floor.
- b. Waxing - The process of applying a layer of wax on a floor.
- c. Liquid Wax - A wax which is mixed with water.

2. List the equipment needed for waxing a floor.

Equipment needed for waxing a floor includes a wet mop, a bucket with a wringer and a water emulsion wax.

3. Identify this machine:

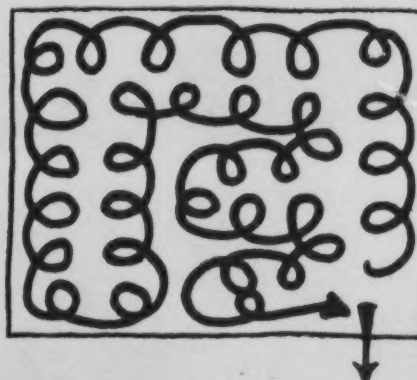
Scrubbing Machine



4. What is the difference between buffing a floor and scrubbing a floor?

The difference between buffing a floor and scrubbing a floor is mainly with the attachments used on the machine and that a cleaning solution is used in scrubbing. Both processes use similar techniques.

5. Pretend this square is a room. Show with your pencil the method and path you would employ to buff the floor.

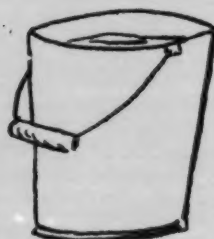


WORKSHEET

1. Name the two methods for cleaning windows.

The two methods for cleaning windows are the "brush and chamois" and the "sponge and squeegee" methods.

2. Identify the following:



a. Bucket



b. Squeegee

3. What three things commonly cause streaking on windows?

Three things which commonly cause window streaking are:

- A. *Use of a solution which is too strong.*
- B. *Use of hard water.*
- C. *Use of abrasive powders.*

4. How do you wash heavy dirt from windows.

All heavy dirt must first be brushed away before any windows are washed.

WORKSHEET

1. What are the two kinds of abrasive material used in sandpaper?

The two kinds of abrasive material used in sandpaper are natural abrasives like garnet and synthetic abrasives like silicon carbide.

2. Which sandpaper is coarser: 150 Grit or 60 grit?

60 Grit

3. Why should sanding be done with the grain?

When sanding is done against (across) the grain, the wood surface is scratched and marred. Sanding with the grain leaves the wood smooth and slick.

4. Name the two most common types of electric sanders.

The two most common types of electric sanders are the orbital (pad) and the belt.

5. What considerations must be made for finishing wood surfaces that come in contact with food.

When food comes in contact with improperly treated wood, the food may absorb some undesirable chemicals. The best way to finish such wooden utensils is to apply a generous amount of vegetable oil rather than a lacquer or varnish. Good finishing oils are corn, olive, and peanut oils.

6. Outline how to apply a danish oil finish.

A. Flood the wood surface with Danish Oil.

B. Allow the oil to soak into the wood.

- 1. Keep the surface wet for 30 minutes.*
- 2. Wipe constantly.*

C. After 30 minutes, wipe the wood surface dry.

WORKSHEET

1. Explain the best routine for cleaning the lavatory.

The best routine for cleaning the lavatory includes these steps:

1. *Gather necessary equipment.*
2. *Collect trash and wastepaper.*
3. *Fill paper towel and toilet paper dispensers.*
4. *Dust and damp wipe horizontal surfaces.*
5. *Clean partitions and walls.*
6. *Clean and polish mirrors, shelves and dispensers.*
7. *Clean wash basins.*
8. *Clean toilets and urinals.*
9. *Sweep out room.*
10. *Check for odors.*
11. *Mop room.*
12. *Proceed to next bathroom.*

2. How do you clean a urinal?

The best routine for cleaning a urinal includes:

1. *Flush to check operation.*
2. *Clean all material in the waste trap.*
3. *Scrub the inside of the urinal and rinse.*
4. *Sponge and dry the outside.*

3. What is the best procedure for cleaning wash basins?

The best routine for cleaning a wash basin includes:

1. *Scrub the inside of the sink with a cleaning agent.*
2. *Rinse the sink.*
3. *Wipe all exposed surfaces with damp sponge.*
4. *Dry and polish all surfaces with a chamois.*

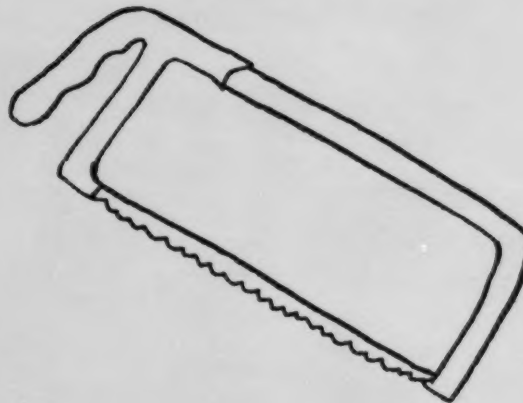
WORKSHEET

1. Identify the following tools.

a. Pipe Wrench



b. Hacksaw



2. When replacing a trap on a sink, what would happen if the threads were crossed and stripped?

If the threads on a sink trap were crossed and stripped, the trap could not be securely attached to the sink. A new pipe with good threads would have to be installed.

3. Give a major advantage of plastic pipe over metal pipe.

The biggest advantage of plastic pipe over metal pipe is its ease in assembling.

WORKSHEET

1. Why should entranceways to buildings get special cleaning attention?

Entranceways to buildings must get special cleaning attention because visitors will judge the building by how it looks on the outside as they enter.

2. How often does the exterior of the building need cleaning?

The exterior of the building needs light cleaning two or three times a year. The removal of heavy grease and grime is usually done only once every five to ten years.

3. What are four things you must do before mowing the grass?

Things to do before mowing the grass include:

- A. Fill gas tank.*
- F. Check oil level.*
- C. Adjust cutting height.*
- D. Know how to operate the mower.*

4. List five safety procedures you should follow when mowing grass.

Safety procedures to follow when mowing grass include:

- A. Read the owner's manual.*
- B. Know how to operate the mower.*
- C. Make sure the mower is in good shape.*
- D. Pick up all debris.*
- E. Only start the mower outside.*
- F. Always use safety shields.*
- G. Be alert.*
- H. Avoid maintenance when the mower is running.*
- I. Keep blade sharp.*

5. If the grass at your building is very weak and full of weeds, what should you do?

If the grass at your building is weak and full of weeds, you should:

- A. Check the type of grass you should use in your climate.*
- B. Have a soil sample taken to determine fertilizer usage.*
- C. Reseed and fertilize lawn.*
- D. Water regularly.*

WORKSHEET

1. List five ways you can detect rodents in your building.

Ways to detect rodents in your building include:

- A. Switch on the lights of a room and observe any movement.*
- B. Move stored objects and look for hiding places.*
- C. Look for signs of gnawing.*
- D. Look for burrows.*
- E. Check for fresh droppings.*
- F. Look in dusty places for tracks.*
- G. Place food in accessible places. Check if they disappear.*

2. TRUE or FALSE. A mouse can squeeze through a hole as small as $\frac{1}{4}$ inch.

True

3. TRUE or FALSE. A rat will eat only food which people eat.

False

4. What are the most common multiple dose rat poisons?
How does this type poison kill?

The most common multiple dose rat poisons are anticoagulants such as chlorophacinone, diphacin, fumarin, pival PMP and warfarin. These poisons kill by causing internal bleeding.

5. Give three hints for the safe use of insecticides.

Hints for the safe use of insecticides include:

- A. Follow directions.*
- B. Wear clothing that covers your arms and legs.*
- C. Never apply outdoors on a windy day.*
- D. Avoid prolonged inhalation.*
- E. Keep children and pets away from treated areas.*
- F. After handling an insecticide, wash immediately.*

6. How should you dispose of insecticide containers?

To dispose of insecticide containers, wrap the cans or bottles in several layers of newspapers and put them in the garbage can.

WORKSHEET

1. For each example, tell which class of fire has started:

- C a. An electric toaster fire
 B b. A can of solvent catches fire
 A c. A bundle of newspapers catches fire
 B d. Smoke and flames erupt from a car engine

2. If you were the custodian in your building, what would you do if you discovered a major fire?

If you discover a major fire in a building, immediately pull the fire alarm (notify the Fire Department). Next, if the fire is very large, leave the building and close windows and doors as you go. If the fire is small, try to fight the fire, but be alert and move fast.

3. MATCHING. Match the type of fire extinguisher with the method for using them:

<u>Extinguishers</u>	<u>Method</u>
<u> 4 </u> Water type	1. Use a quick side to side motion
<u> 1 </u> Dry Chemical	2. Sweep slowly from side to side
<u> 2 </u> Carbon Dioxide	3. Direct the stream toward the floor in front of the fire
<u> 3 </u> Foam	4. Direct at the base of the fire
<u> 5 </u> Dry Powder	5. Shovel on

COAL MINER

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- Coal Miner - Today, Mining Enforcement and Safety Administration, 4800 Forbes Ave., Pittsburgh, Pa. 15213
- Energy vs Ecology - The Great Debate, Consolidation Coal Company, Consol Plaza, 1800 Washington Rd., Pittsburgh, Pa. 15241.
- The Harvesting of Coal, Consolidation Coal Company, Consol Plaza, 1800 Washington Rd., Pittsburgh, Pa. 15241.
- Introduction to Underground Coal Mining: One, Mining Enforcement and Safety Administration, 4800 Forbes Avenue, Pittsburgh, Pa. 15213.
- New Concept in Mining, Ideal Pictures Film Library, 4431 West North Ave., Milwaukee, Wisc. 53208.
- Roof Bolting in Coal Mines, Mining Enforcement and Safety Administration, 4800 Forbes Ave., Pittsburgh, Pa. 15213.
- Safety in Longwall Mining, Mining Enforcement and Safety Administration, 4800 Forbes Ave., Pittsburgh, Pa. 15213.
- Safety in Strip Mining, Mining Enforcement and Safety Administration, 4800 Forbes Ave., Pittsburgh, Pa. 15213.
- Underground Coal Mine Blasting, Mining Enforcement and Safety Administration, 4800 Forbes Ave., Pittsburgh, Pa. 15213.

II. BOOKS

- Introduction to Underground Coal Mining. Washington: United States Department of Interior, 1977.
- Martens, Charles D. Ed. Underground Mining. Oil City: Derrick Printing, 1972.
- Safety Manual Series. Washington: United States Department of Interior, 1977.
- Surface Mining. Washington: United States Department of Interior, 1976.

III. EQUIPMENT AND SUPPLIES

Roof bolt
 Personal safety pack
 Miners helmet

WORKSHEET

1. Which is the hardest coal?

The hardest coal is anthracite coal.

2. On the following map of the United States, draw where the four types of coal deposits are located.

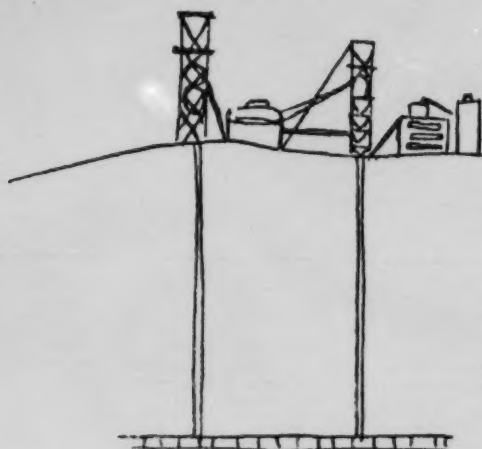


3. Tell what the following people do in an underground mine:

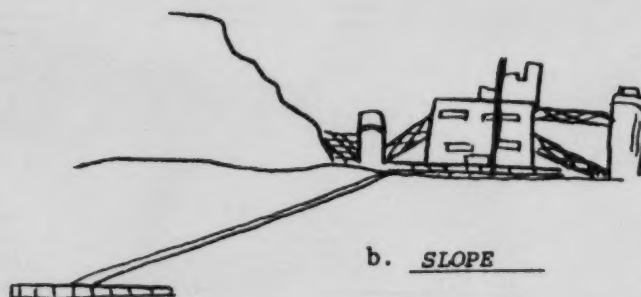
- a. miner operator - an individual who runs a longwall, shortwall or continuous miner.
- b. roof bolter - an individual who plots and drills roof bolts. Usually operates a machine called a roof bolter.
- c. section boss - an individual who oversees the safety and operation of the mine in one area.
- d. dispatcher - an individual who controls movement of heavy equipment in a mine.

WORKSHEET

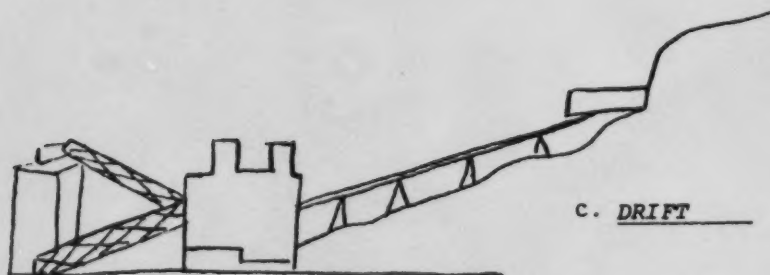
1. Identify the following mine types:



a. SHAFT



b. SLOPE



c. DRIFT

2. Describe how a shaft mine operates.

A shaft mine works on coal which is far below the surface. A vertical shaft is excavated down to the coal seam and horizontal tunnels are cut through the seam for removal of the ore. Elevators in the shaft raise and lower men, equipment and coal. As the mine spreads out, more shafts are dug to aid in the access to the seam.

3. How deep are shaft mines?

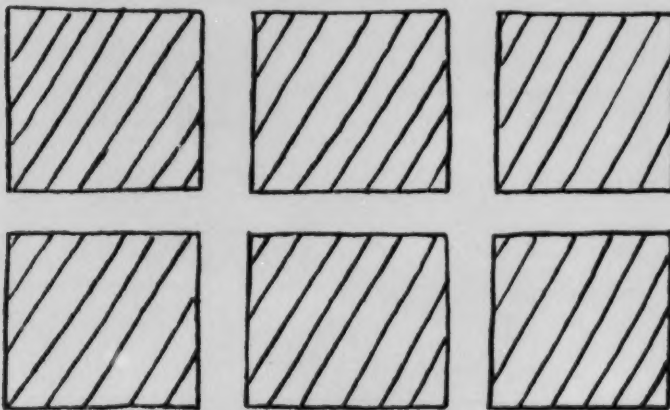
Shaft mines usually range from 200 to 1500 feet in depth, but some mines are down more than a mile.

WORKSHEET

1. Name the five methods of mining coal in an underground mine.

- A. Conventional
- B. Continuous
- C. Longwall
- D. Shortwall
- E. Handload

2. What type of mining method is shown in the following:



Room and Pillar

3. What is the name of the method in which coal is removed from roof-supporting pillars until the roof caves in?

Retreat mining is the name of the method in which coal is removed from roof-supporting pillars until the roof caves in.

4. Which form of mining uses explosives?

Conventional mining is the form of mining which uses explosives.

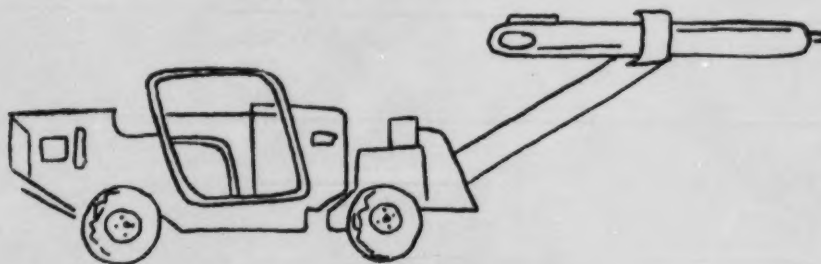
WORKSHEET

1. Name the five steps in the conventional mining of coal.

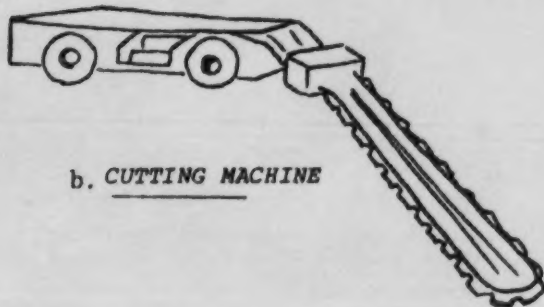
- a. Support the roof
- b. Cut the face
- c. Drill the face
- d. Shoot the face
- e. Load and haul the coal

2. TRUE or FALSE. The process of cutting into and along the wall of coal being mined to provide a places for coal to go when blasted is called shooting the face.

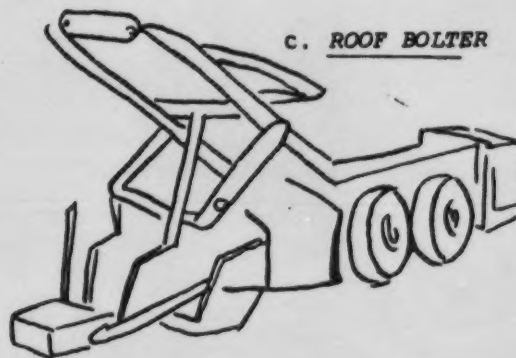
3. Identify the following conventional mining equipment.



a. FACE DRILL



b. CUTTING MACHINE



c. ROOF BOLTER

WORKSHEET

1. Name the three steps in the continuous mining of coal.

a. Extract the coal

b. Haul the coal

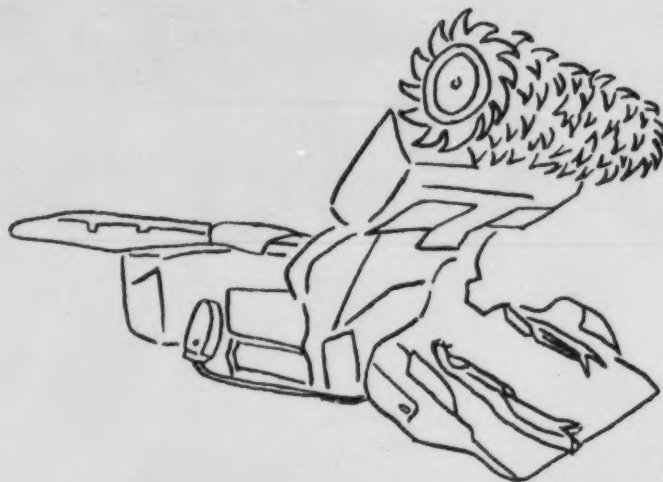
c. Support the roof

2. TRUE or FALSE. With continuous mining, roof bolting is not necessary.

3. TRUE or FALSE. The continuous miner can mine into the face only as far as the operator is under supported roof.

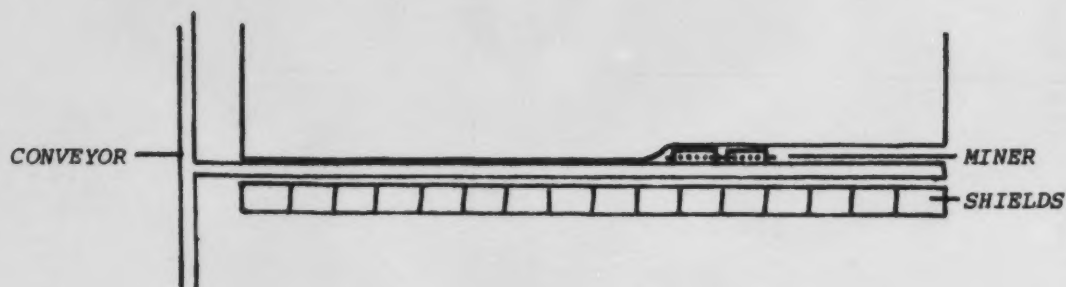
4. Identify the following piece of equipment.

a. Continuous Miner



WORKSHEET

1. Draw a picture of a longwall mine and write how it operates.



The longwall miner is used on coal seams which are large and uniform. The miner rides back and forth on a track across a face which is several hundred feet long. The machine has two cutting heads that cut the coal and allow it to fall onto a conveyor for removal. As the coal is removed, the miner and the safety shields automatically move forward.

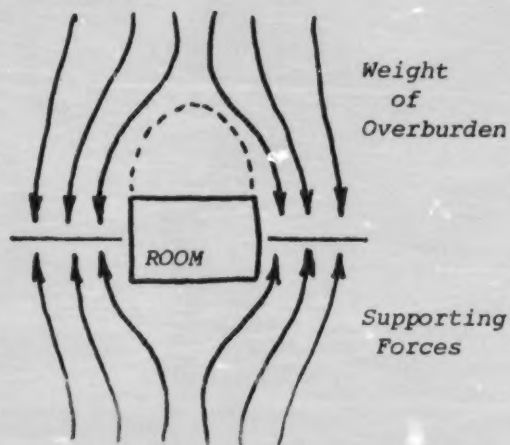
2. Identify the following piece of equipment.

Longwall miner



WORKSHEET

1. Draw a picture of a mine room and explain the nature of the force from the overburden.

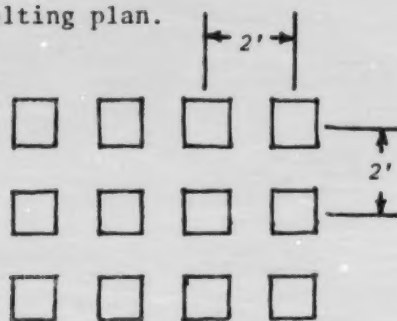


In a mine room, the total load of overburden is equal and opposite to the supporting forces of the earth below. Only the minor load (dotted line above room) must be mechanically supported.

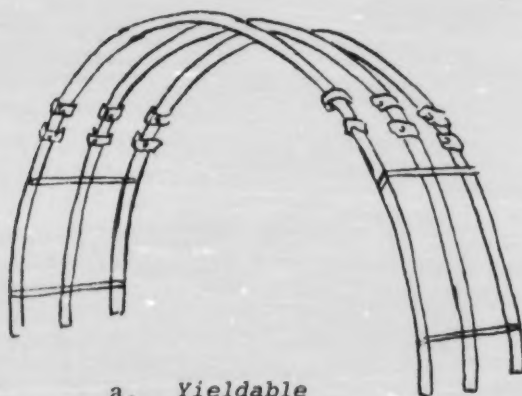
2. Define scaling.

Scaling is knocking loose layers of shale or other material with a bar.

3. Draw a roof bolting plan.



4. Identify the following:



a. Yieldable
Steel Arch



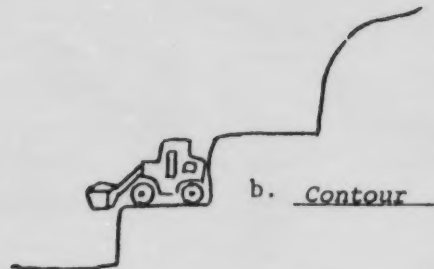
b. Roof Bolt

WORKSHEET

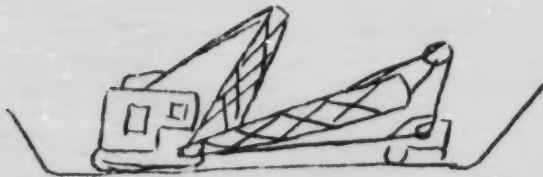
1. Identify the following surface mines:



a. Open Pit



b. Contour



c. Area

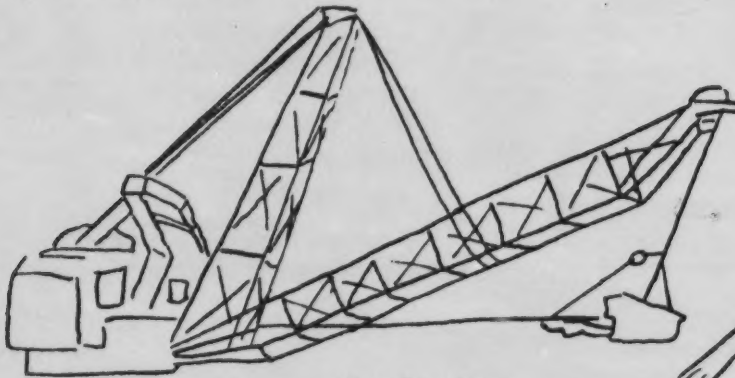
2. TRUE or FALSE. Contour mining is done in the flat mid-west states.

3. Define Fragmentation.

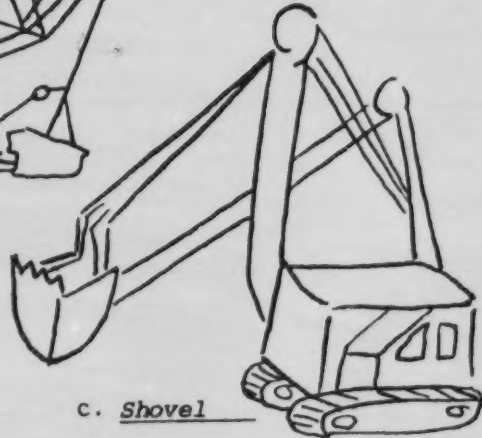
Fragmentation is the process of breaking up the overburden into pieces by blasting.

WORKSHEET

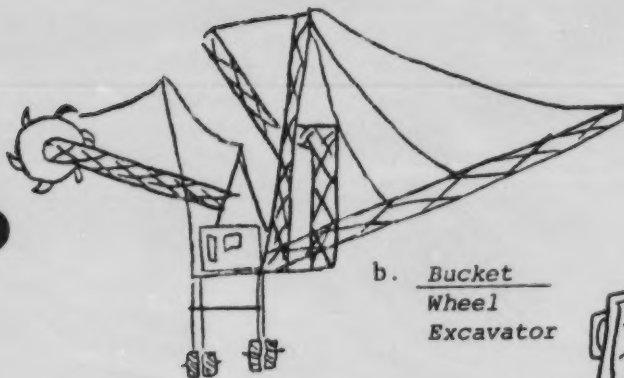
1. Identify the following equipment:



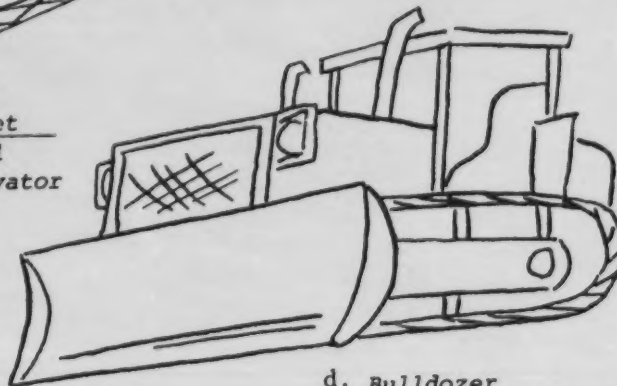
a. Dragline



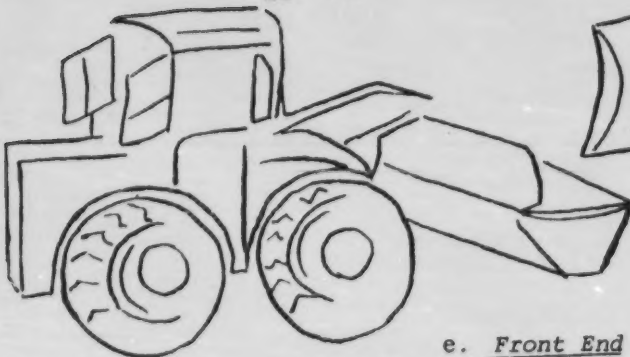
c. Shovel



b. Bucket
Wheel
Excavator



d. Bulldozer



e. Front End
Loader

2. Name the equipment used to remove overburden in a surface mine which is loose and needs no blasting.

The heavy equipment used to remove overburden which is loose and soft are:

- A. Dragline
- B. Shovel
- C. Bulldozer

- D. Bucket Wheel Excavator
- E. Front End Loader

WORKSHEET

1. Define Crusher

A crusher is a coal processing machine which breaks up over-sized chunks of coal.

2. What does the raw coal screen do in the processing of coal.

The raw coal screen separates crushed coal into three sizes:

- A. Coarse*
- B. Intermediate*
- C. Fine*

3. Draw a diagram at a modern coal processing operation.

Instructor:

See pages 20-21 in The Story of Coal.

WAREHOUSE OPERATOR

INSTRUCTIONAL RESOURCESI. AUDIO-VISUAL

- DDT in the Control of Household Insects, U.S. Army, The Pentagon, Washington, D.C. 20310.
- Extinguish That Fire, L.A. City Fire Dept., Administrative Services, Los Angeles, Calif. 90012.
- Inventory Management, Educational Film Distributors.
- Material Handling Principles in Transportation, U.S. Dept. of Defense, The Pentagon, Washington, D.C. 20301.
- Materials Control, McGraw-Hill Films, 1221 Ave. of the Americas, New York, N.Y. 10020.
- Materials Handling in Receiving, Warehousing and Shipping, General Electric Educational Films, Corp. Park, Bldg. 705, Scitua, N.Y. 12302.
- Packed for Impact, Royal Institute of Chemistry, 30 Russell Square, London W C 1.
- Ratproofing (2nd Ed), U.S. Public Health Service, Welfare Building, 4th St. and Independence Ave. SW, Washington, D.C. 20201.

II. BOOKS

- Hatchett, Melvin S. Warehousing. Austin: University of Texas at Austin, 1974.
- Warehouse Worker. Dover: Delaware Department of Education, 1978.

III. EQUIPMENT AND SUPPLIES

None

WORKSHEET

1. Define materials handling.

Materials handling refers to the moving of goods during receiving, storing, and delivering operations.

2. What is meant by "The least handling is the best handling?"

The greatest economy in moving materials is gained by moving goods very little or not at all.

3. Why should equipment ratings never be exceeded?

Overloading of equipment causes excessive wear and creates additional accident potential.

4. How are major equipment items generally classified?

Major equipment is generally classified as mobile or fixed and powered or non-powered.

5. Name the four types of conveyors.

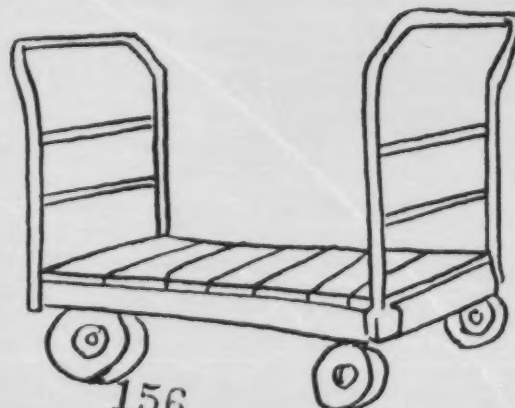
- a. gravity roller
b. power driven belt
c. gravity wheel
d. dragline

6. Identify the following equipment:

- a. Two-Wheel
Hand Truck



- b. Forklift



- c. Four-Wheel
Platform
Hand Truck

WORKSHEET

1. What is a forklift designed to do?

A forklift is designed to lift large, bulky objects and move them to another position.

2. Give three safety procedures to follow when operating a forklift.

a.

INSTRUCTOR:

b. *See pages 35 to 39 in Warehousing and Operators manual for your forklift.*

c.

3. Explain how to pick up a pallet with a forklift.

To pick up a pallet, lower forks level but clear of the floor. Spread forks as wide as possible and move under pallet. Raise the pallet with the mast vertical or tilted slightly back.

4. Why should slow, easy starts and smooth stops be made with the forklift?

Slow, easy starts and smooth stops should be made with the forklift because this will extend the life of the equipment, but more important, this will prevent any load from shifting or falling from the forks.

5. What is this forklift operator doing wrong?

- A. *He isn't watching where he is going.*
- B. *He has the mast tilted forward.*
- C. *He has the forks too high for the load.*
- D. *He has the load poorly arranged on the forks.*



WORKSHEET

1. What is the basic requirement of effective warehousing?

The basic requirement of effective warehousing is prompt and accurate processing of incoming merchandise.

2. Explain the procedure for unloading a boxcar when the goods will be stored close by.

When unloading a boxcar for close-by storage, the forklift operator should place a pallet at the door. Two workers load the pallet. The operator removes the pallet, replaces it with an empty, checks and records items on pallet and moves it to the storage area. The cycle is repeated till finished.

3. Explain what a common carrier is.

A common carrier is an agency which delivers goods for a company. It could be by truck, van, train, plane, etc.

4. From the following invoice, identify:

- a. Who sent the goods Bill's Radio Hut
- b. Who was the carrier? Motor Freight
- c. How many motors were received? 2
- d. What was backordered? 1 Battery

BILL'S RADIO HUT			
PHONE 782-9310		187 LAWMAN AVE. BLOOMINGTON, IND. 47401	
SOLD TO _____		DATE 10-3-80	
ADDRESS _____		PHONE _____	
VIA MOTOR FREIGHT		CHARGE NA	WT. 2103 LBS.
QUANTITY	ITEM	PRICE	TOTALS
10	RADIOS	@ 5.00	\$ 50.00
2	MOTORS	10.00	20.00
1	BATTERY	1.95	BACKORDERED
3	CASSETTES	3.50	11.00
SUB TOTAL			82.95
TAX			2.00
TOTAL			\$ 84.95
FORM 809-2-37		RECEIVED BY <u>[Signature]</u>	

WORKSHEET

1. What is the prime objective in warehouse planning?

The prime objective in warehouse planning is the maximum use of available space.

2. Where should fast-moving items be stored?

Fast-moving items should be stored in readily accessible areas, where they can be handled quickly and efficiently.

3. What is a short lot?

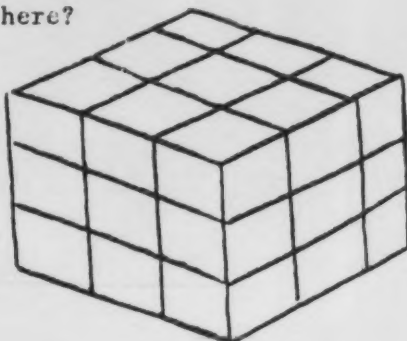
A short lot is one to three individually tiered pallet stacks piled to maximum height.

4. What is a pallet?

A pallet is a portable platform on which goods may be placed for easy transporting and storage.

5. What pallet pattern is shown here?

Block



6. Name three flammable liquids stored in the shop.

a. _____

b. _____

c. _____

INSTRUCTOR:

Check flammable liquids in your shop.

WORKSHEET

1. Name the four foods most likely to attract insects.

- a. Whole grain
- b. Grain products
- c. Dried fruits and vegetables
- d. Confections

2. Describe the brown rat.

The brown rat varies in color from light brown to brown-black, is about 18 inches in length including a 7 inch tail and weighs about a pound.

3. How do rodents usually enter a building?

Rodents usually enter a building through open windows, doors and holes around pipes and wires.

4. What are two advantages of trapping?

Two advantages of trapping are:

- A. *Safety to humans.*
- B. *Ease with which animals can be located and removed.*

5. When should poison be used in rodent control?

Poison should be used when infestation is severe.

WORKSHEET

1. Name the four general types of stock control systems.

a. Supervision

c. Periodic inventory

b. Statistical

d. Perpetual inventory

2. Which stock control system is least effective? Why?

The least effective stock control system is by supervision because no record keeping is involved.

3. What is statistical control?

Statistical control is a stock control system that deals with dollars and cents and is not concerned with merchandise. It allows for continuous checks on the spending of certain departments and, therefore, controls the operation of the warehouse based on sales.

WORKSHEET

1. Define unit package.

A unit package is the first tie, wrap or container applied to a single item(s) which provides a complete and properly identified package.

2. Name the two fundamental principles of packing.

The two fundamental principles of packing are:

- A. Proper selection of the container.*
- B. Use of the best packing method.*

3. What type of shipping container is most commonly used?

The most commonly used shipping container is the fiberboard box.

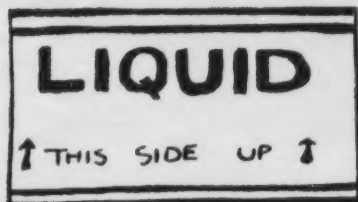
4. What is the purpose of cushioning material?

The primary purpose of cushioning material is to protect the container contents from damage.

5. What handling considerations should be made for:



- a. Handle carefully, do not throw, do not pile heavy objects on top, etc.



- b. Keep right side up, don't stack where it might tumble over, don't throw, etc.

WORKSHEET

1. Name the three basic methods of order processing.

- a. Progressive
- b. Simultaneous
- c. Single-Line

2. Which type of order processing is used most in small warehouse operations?

The type of order processing most often used in a small warehouse is the progressive order-filling method.

3. Give the meanings for the following abbreviations:

- a. FOB Free on Board
- b. BL Barrel
- c. CS Case
- d. DZ Dozen
- e. EA Each

WORKSHEET

1. What is the major danger to rubber products?

The major danger to rubber products is rats and fire.

2. What is the major danger to metal products?

The major danger to metal products is corrosion.

3. What causes deterioration in paint?

Paint deteriorates due to age.

4. How do paints react to freezing?

Paints deteriorate with freezing temperatures.

5. How can the storage life of paint be increased?

The storage life of paint can be increased by periodic turning.

WORKSHEET

1. What is the main objective of security, housekeeping and fire protection?

The main objective of security, housekeeping and fire protection is the protection of life and property.

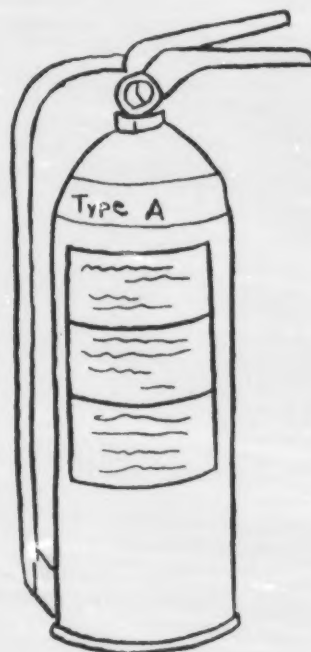
2. What is an advantage of wire barriers?

The main advantage of wire barriers is the free circulation of air and light.

3. Why is the danger of fire greater in a warehouse than in any other business?

The danger of fires starting in the warehouse is the large quantities of different materials stored in a very concentrated area.

4. TRUE or FALSE. The following fire extinguisher is designed to put out a wood fire.



Competency Based Education Curriculum
for

PREVOCATIONAL MANUFACTURING EXPLORATION

Prepared by

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TAU Associates, Inc.

Produced at

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March 1981

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STUART MATERIAL

TABLE OF
CONTENTS

CAREER INFORMATION SHEET

UNIT OF STUDY: Wrought Iron

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Metal Fabricating

DOT OCCUPATIONAL GROUP: Miscellaneous

OCCUPATIONAL OVERVIEW: The ornamental-iron worker (wrought iron fabricator) designs, forms and assembles iron products, such as furniture, shelf brackets, gates, hand railings and decorative pillars. Prepares sketches, sizes and details of products to be manufactured. Lays-out and marks stock for cutting into components. Operates machines to cut, bend and fit parts such as shears, drill presses, brakes and welders.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

809.381-010	Fabricator-Assembler, Metal Products
809.381-022	Ornamental-Iron Worker
809.381-026	Ornamental-Iron Worker Apprentice
809.681-010	Assembler, Unit
709.684-066	Riveter, Hand
709.684-014	Assembler, Metal Furniture
	Design Engineer, Products

LESSON 1

UNIT: Wrought Iron

OCCUPATIONAL COMPETENCY: Design a Wrought Iron Project

LEARNING OBJECTIVES:

1. Select a Wrought Iron Project

Activities:

- a. Read pages 115-122 in Technical Metals.
- b. Look at several wrought iron projects suggested by the teacher or in project books.
- c. Select a project you would like to make.

Materials:

None

2. Prepare Several Project Designs

Activities:

- a. On the sheet provided, sketch three different designs of the project you have chosen to make.
- b. With the help of the teacher, decide which is your best design.

Materials:

None

3. Finalize the Project Design

Activities:

- a. Make a working drawing of your approved design.
- b. Add to your drawing, those dimensions necessary for making it.

Materials:

Pencil, paper, ruler, drafting instruments

EVALUATION:

1. Have the instructor evaluate your final wrought iron project design for style, accuracy and ease of construction.
2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.



SKETCH SHEET

DIRECTIONS: Sketch your Wrought Iron Project Designs on this sheet. Be neat.

SKETCH 1

SKETCH 2

SKETCH 3



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WROUGHT IRON

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Selecting a Wrought Iron Project					
Preparing Several Project Designs					
Finalizing the Project Design					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Wrought Iron

OCCUPATIONAL COMPETENCY: Form the Parts of a Wrought Iron Project

LEARNING OBJECTIVES:

1. Lay-out the Material for the Project

Activities:

- a. Read pages 103-104 in Technical Metals.
- b. Measure all parts for cutting with a hacksaw.

Materials:

Steel rule, combination square, scribe, wrought iron stock

2. Cut the Material to the Correct Length

Activities:

- a. Watch a demonstration on the correct use of a hacksaw.
- b. Practice using a hacksaw by cutting scrap material.
- c. Cut the measured wrought iron to length.

Materials:

Hacksaw, wrought iron stock

3. Bend and Twist the Material to the Correct Shape

Activities:

- a. Read pages 105-111 in Technical Metals.
- b. Read pages 35-40 in Metalworking.
- c. Watch a demonstration on bending and twisting wrought iron using hand tools.
- d. Watch a demonstration on bending and twisting wrought iron using machines.
- e. Bend and twist the cut wrought iron to the shapes shown in working drawing.

Materials:

Vise, wrought iron stock, bending forks, bending jig
universal bender, wrench, ballpeen hammer, steel rule

EVALUATION:

1. Have the instructor evaluate the formed parts of your wrought iron project for good bends, smooth curves and correct size.
2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.

Little, Richard and Little, Sherry. Metalworking. American Technical Society, Chicago, Illinois, 1979.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WROUGHT IRON

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Laying-out the Material for the Project					
Cutting the Material to the Correct Length					
Bending and Twisting the Material to the Correct Shape					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Wrought Iron

OCCUPATIONAL COMPETENCY: Assemble a Wrought Iron Project

LEARNING OBJECTIVES:

1. Prepare Project Parts for Assembly

Activities:

- a. Read page 112 in Technical Metals.
- b. Watch a demonstration on hand and machine drilling of wrought iron.
- c. Practice drilling holes on scrap material.
- d. Lay-out the necessary holes and drill the project parts for later assembly.

Materials:

Hand drill, electric drill, drill press, drill bits, steel rule, combination square, scribe, ballpeen hammer, center punch

2. Assemble the Parts of the Wrought Iron Project

Activities:

- a. Read pages 113-114 in Technical Metals.
- b. Watch a demonstration on riveting wrought iron.
- c. Practice riveting on scrap material.
- d. Assemble the project parts and rivet them together.

Materials:

Ballpeen hammer, rivets, rivet set, riveting block

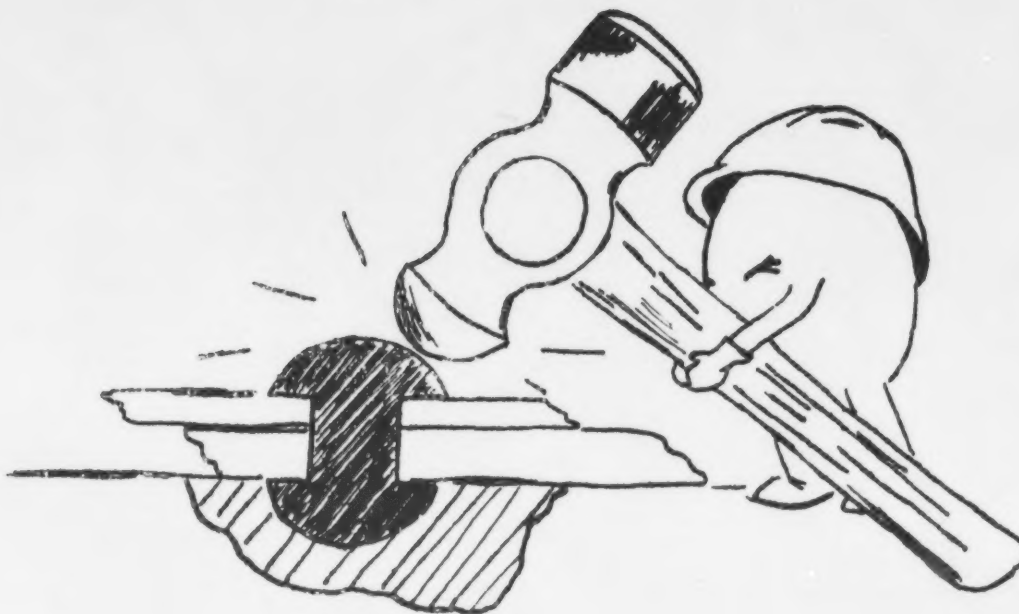
EVALUATION:

1. Before you put your project together, have the instructor check your drilled parts for alignment.

2. Have the instructor evaluate your assembled project for accuracy with your working drawing, properly headed rivets, and tight joints.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.

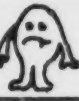


STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ WROUGHT IRON _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Preparing Project Parts for Assembly					
Assembling the Parts of the Wrought Iron Project					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Foundry

DOT OCCUPATIONAL CATEGORY: Processing

DOT OCCUPATIONAL DIVISION: Ore Refining and Foundry

DOT OCCUPATIONAL GROUP: Molders, Coremakers, Foundry

OCCUPATIONAL OVERVIEW: The foundry worker prepares sand for casting metal, assembles flasks, positions pattern and readies the mold. Weighs material and charges furnace, checks temperature of melt and pours the casting. Breaks sand mold, removes sprues and gates and finishes casting. Uses machines to ram the mold and pour the casting such as pneumatic hammers, grinders, and crucible furnaces.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

518.361-010	Molder
518.381-014	Coremaker
512.362-018	Furnace Operator
514.684-010	Caster
519.687-022	Foundry Worker, General
519.687-042	Test Worker

LESSON 4

UNIT: Foundry

OCCUPATIONAL COMPETENCY: Prepare a Foundry Mold

LEARNING OBJECTIVES:

1. Select a Pattern for Casting

Activities:

- a. Read pages 231-241 in Technical Metals.
- b. View several foundry patterns provided by the instructor, and look at finished castings made from these patterns.
- c. From the patterns available, select one for casting.

Materials:

None

2. Ram a Mold

Activities:

- a. Read pages 241-245 in Technical Metals.
- b. Read pages 93-100 in Metalworking.
- c. Watch a demonstration on ramming a mold.
- d. Prepare a mold for casting.

Materials:

Pattern, sand, flask, hand rammer, riddle, sprue cutter, riser cutter, trowel, spoon, lifter, strike-off bar, bellows, parting compound, bottom board, turn-over board, draw pins, bulb sponge, vent wire, molding bench

EVALUATION:

1. Have the instructor evaluate your mold on clean, crisp images, firm packing of sand, proper gates and sprues, and tight lock-up.
2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.

Little, Richard and Little, Sherry. Metalworking. American Technical Society, Chicago, Illinois, 1979.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT FOUNDRY

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Selecting a Pattern for Casting					
Ramming a Mold					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Foundry

OCCUPATIONAL COMPETENCY: Make a Metal Casting

LEARNING OBJECTIVES:

1. Prepare the Metal for Casting

Activities:

- a. Read pages 234-237 and 243-244 in Technical Metals.
- b. Read pages 101-103 in Metalworking.
- c. Watch a demonstration on melting metal in a crucible furnace.
- d. Charge the furnace and melt the metal for pouring.

Materials:

Crucible furnace, crucible, aluminum stock, pyrometer, crucible tongs

2. Pour the Molten Metal into the Mold

Activities:

- a. Read pages 237 and 243-244 in Technical Metals.
- b. Watch a demonstration on how to make a casting.
- c. Set up the foundry equipment for the pouring process.
- d. Pour the metal into the mold.
- e. After the metal casting has cooled, remove it from the mold.

Materials:

Crucible furnace, crucible, crucible tongs, carrying shank, asbestos clothing, ingot mold, ladle

EVALUATION:

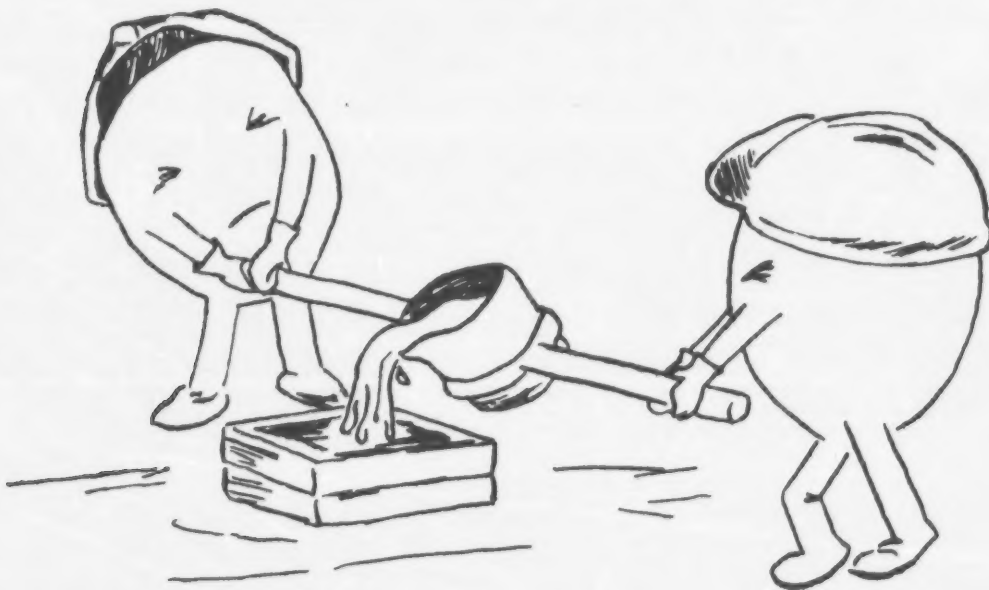
1. Have the instructor check your molten metal for proper temperature prior to casting.

2. Have the instructor evaluate your casting for smoothness, accuracy and absence of flashing.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Chas. A. Bennett Co., Inc., Peoria, Illinois, 1968.

Little, Richard and Little, Sherry. Metalworking. American Technical Society, Chicago, Illinois, 1979.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT FOUNDRY

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Preparing the Metal for Casting					
Pouring the Molten Metal into the Mold					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Block Printing

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Graphic Art Work

DOT OCCUPATIONAL GROUP: Graphic Art Work

OCCUPATIONAL OVERVIEW: The block printer cuts letters and designs in linoleum and mounts cut articles on blocks for use in printing posters and other large or irregular objects. Traces patterns in reverse on linoleum, cuts around drawing with block cutting knives and prints in a hand operated press. Engraves some work in wood.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

979.684-014	Engraver II
979.281-014	Engraver, Block
976.361-010	Reproduction Technician
652.382-010	Printer

LESSON 6

UNIT: Block Printing

OCCUPATIONAL COMPETENCY: Prepare a Block Printing Design

LEARNING OBJECTIVES:

1. Identify Good Block Printing Designs

Activities:

- a. Read pages 50-51 in Graphic Arts/Kagy.
- b. Read page 33 in Graphic Arts/Swerdlow.
- c. Observe the characteristics of several good block printing designs.

Materials:

None

2. Select and Prepare a Block Printing Design

Activities:

- a. Choose an idea for a block printing design.
- b. On the sheet provided, sketch three different block printing designs using your idea.
- c. With the instructor's help, select your best design.
- d. Draw your design full size for later printing.

Materials:

None

EVALUATION:

1. Have the instructor evaluate your full size design for style and simplicity.
2. Complete the attitude sheet.

RESOURCES:

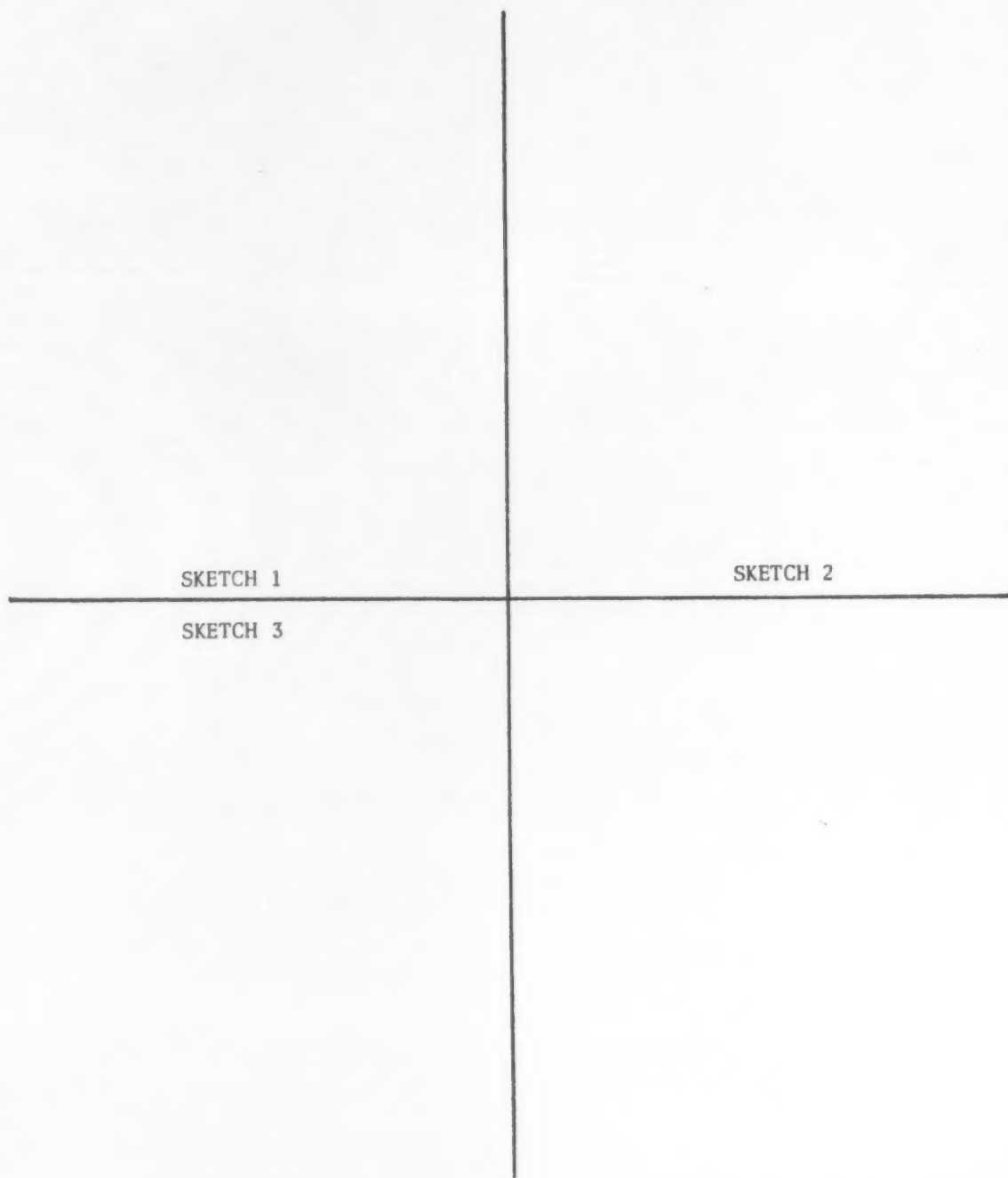
Kagy, Frederick D. Graphic Arts. Goodheart-Willcox Co., Inc., South Holland, Illinois, 1970.

Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.



SKETCH SHEET

DIRECTIONS: Sketch your Block Printing Project Designs on this sheet. Be neat.



STUDENT ATTITUDE SHEET

for

CLUSTER _____

MANUFACTURING _____

UNIT _____

BLOCK PRINTING _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Good Block Printing Designs					
Selecting and Preparing a Block Printing Design					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Block Printing

OCCUPATIONAL COMPETENCY: Prepare a Block for Printing

LEARNING OBJECTIVES:

1. Transfer the Design to the Block

Activities:

- a. Read pages 50-51 in Graphic Arts/Kagy.
- b. Read pages 33-34 in Graphic Arts/Swerdlow.
- c. Watch a demonstration on transferring designs to a block.
- d. Transfer your design to a block.

Materials:

Design, carbon paper, pencil, linoleum block, masking tape

2. Cut the Design

Activities:

- a. Read pages 50-51 in Graphic Arts/Kagy.
- b. Read pages 34-35 in Graphic Arts/Swerdlow.
- c. Watch a demonstration on cutting designs into a block.
- d. Practice using block carving tools on scrap material.
- e. Cut your design into a block.

Materials:

Linoleum block carving tools, bench hook, linoleum block, scrap linoleum

EVALUATION:

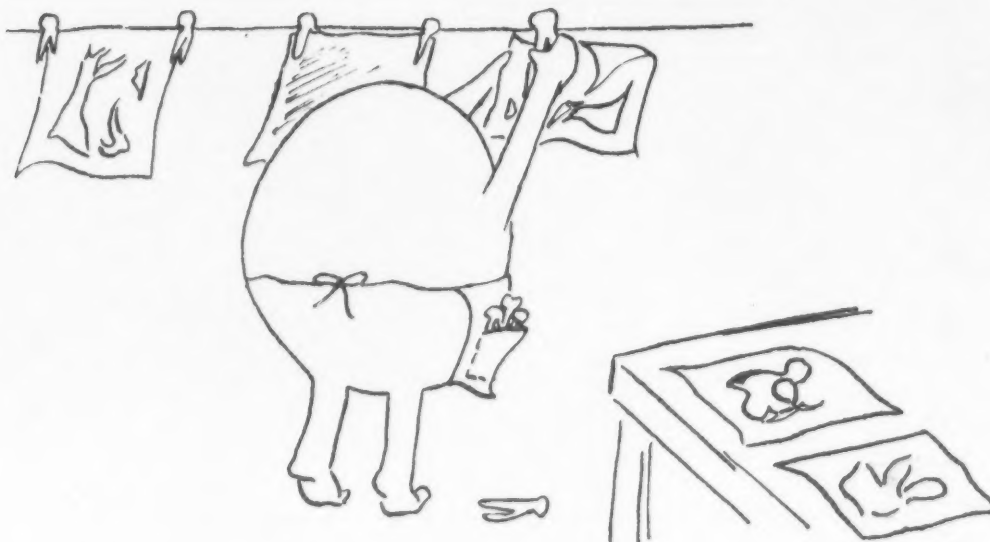
1. Have the instructor check the transferred design before you cut your block.

2. Have the instructor evaluate your completed block for depth of cut, slanted edges and accuracy.
3. Complete the attitude sheet.

RESOURCES:

Kagy, Frederick D. Graphic Arts. Goodheart-Willcox Co., Inc., South Holland, Illinois, 1970.

Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT BLOCK PRINTING

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Transferring the Design to the Block					
Cutting the Design					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Block Printing

OCCUPATIONAL COMPETENCY: Make a Block Print

LEARNING OBJECTIVES:

1. Print the Block Design

Activities:

- a. Read pages 39-41 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on printing a block.
- c. Print the block.

Materials:

Proof press, brayer, ink, paper, linoleum block, glass plate

2. Make Final Corrections to the Block

Activities:

- a. With the help of the teacher, decide what corrections should be made to the block for better printing.
- b. Make the corrections to the block.
- c. Prepare a final print.

Materials:

Linoleum block carving tools, bench hook, linoleum block, proof press, brayer, ink, paper, glass plate

EVALUATION:

1. Have the instructor evaluate your final block print for neatness and accuracy.
2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT BLOCK PRINTING

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Printing the Block Design					
Making Final Corrections to the Block					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Screen Printing

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Graphic Art Work

DOT OCCUPATIONAL GROUP: Graphic Art Work

OCCUPATIONAL OVERVIEW: The screen printer lays-out and prepares stencils for use in silk screen printing. Adheres stencil to screen and prints lettering and designs by pouring paint onto stencil and drawing squeegee across silk screen. Produces images on posters, targets, instrument dials, furniture, street signs, glasses, toys and t-shirts. May operate hand fed or machine fed press.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

979.684-034	Screen Printer
979.684-038	Silk Screen Repairer
979.681-022	Silk Screen Cutter
979.687-022	Screen Printer Helper
709.484-010	Silk Screen Frame Assembler

LESSON 9

UNIT: Screen Printing

OCCUPATIONAL COMPETENCY: Cut a Silk Screen Stencil

LEARNING OBJECTIVES:

1. Identify Good Silk Screen Designs

Activities:

- a. Read page 76 in Graphic Arts/Kagy.
- b. Read page 94 in Graphic Arts/Swerdlow.
- c. Observe good examples of silk screen designs provided by the instructor or in design books.

Materials:

None

2. Prepare a Final Silk Screen Design

Activities:

- a. Select an idea for a silk screen design.
- b. On the sheet provided, sketch three different designs for silk screen printing.
- c. With the help of the teacher, choose the best design.
- d. Prepare a final, full-size design to be used as a pattern for a silk screen stencil.

Materials:

Drafting instruments, paper, ruler, pencil

3. Cut a Silk Screen Stencil

Activities:

- a. Read pages 76-77 in Graphic Arts/Kagy.
- b. Read pages 94-96 in Graphic Arts/Swerdlow.

- c. Watch a demonstration on how to cut a silk screen stencil.
- d. Cut your design from the stencil material provided by your teacher.

Materials:

Stencil material, x-acto knife, design, masking tape

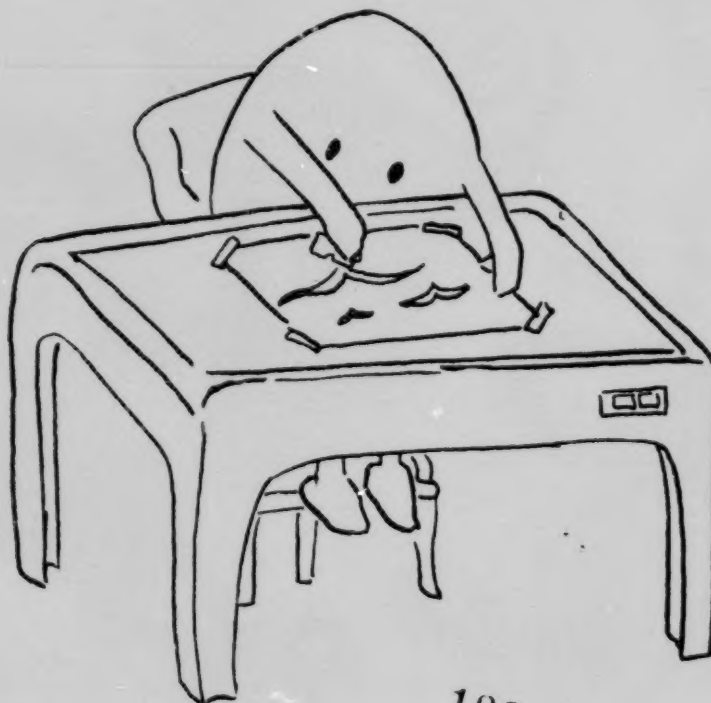
EVALUATION:

1. Have the instructor evaluate the completed silk screen stencil for accuracy and neatness.
2. Complete the attitude sheet.

RESOURCES:

Kagy, Frederick D. Graphic Arts. Goodheart-Willcox Co., Inc., South Holland, Illinois, 1970.

Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.



SKETCH SHEET

DIRECTIONS: Sketch your Silk Screen Project Designs on this sheet. Be neat.

SKETCH 1

SKETCH 2

SKETCH 3

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT SCREEN PRINTING

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Good Silk Screen Designs					
Preparing a Final Silk Screen Design					
Cutting a Silk Screen Stencil					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Screen Printing

OCCUPATIONAL COMPETENCY: Print from a Silk Screen Stencil

LEARNING OBJECTIVES:

1. Adhere the Stencil to the Screen

Activities:

- a. Read page 77 in Graphic Arts/Kagy.
- b. Read pages 94-96 in Graphic Arts/Swerdlow.
- c. Watch a demonstration on adhering stencils to a silk screen frame.
- d. Adhere your stencil to a silk screen frame.

Materials:

Lacquer thinner, masking tape, newspapers, rags, silk screen frame, stencil

-or-

Ink, squeegee, newspaper, silk screen frame, masking tape, stencil, spatula

2. Print the Design

Activities:

- a. Read pages 77-79 in Graphic Arts/Kagy.
- b. Read Unit 20, pages 100-103 in Graphic Arts/Swerdlow.
- c. Watch a demonstration on printing from a silk screen stencil.
- d. Print three copies of your silk screen design.

Materials:

Ink, squeegee, silk screen frame, paper, silk screen press, spatula

EVALUATION:

1. Have the instructor evaluate your silk screen prints for clean lines, opaque images and absence of ink smears.
2. Complete the attitude sheet.

RESOURCES:

Kagy, Frederick D. Graphic Arts. Goodheart-Willcox Co., Inc., South Holland, Illinois, 1970.

Swerdlow, Robert M. Graphic Arts. American Technical Society, Chicago, Illinois, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SCREEN PRINTING

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Adhering the Stencil to the Screen					
Printing the Design					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Electricity/Electronics

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Electrical Assembling, Installing & Repairing

DOT OCCUPATIONAL GROUP: A11

OCCUPATIONAL OVERVIEW: The Electrical/Electronics Engineer applies the laws of electrical energy to the generation, transmission and use of electricity. Designs and develops the machinery and equipment for producing and using electricity. Specializes in areas such as atomic power generation, electrical and electronic components, radio and television broadcasting, telephones and computer engineering.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

003.061-010	Electrical Engineer
003.161-014	Electronics Technician
003.281-010	Electrical Drafter
720.281-018	Television and Radio Repairer
723.381-010	Electrical-Appliance Repairer
824.261-010	Electrician

LESSON 11

UNIT: Electricity/Electronics

OCCUPATIONAL COMPETENCY: Describe Magnets and Magnetism

LEARNING OBJECTIVES:

1. Identify the Types of Magnets

Activities:

- a. Read pages 447-448 in General Industrial Education.
- b. Read pages 171-172 in General Shop for Everyone.
- c. Observe examples of magnets and identify each type on the work sheet provided.

Materials:

Assortment of magnets

2. Discuss the Principles of Magnetism

Activities:

- a. Read pages 172-173 in General Shop for Everyone.
- b. Read pages 48-49 in Electricity and Electronics.
- c. List three principles of magnetism on the work sheet provided.

Materials:

None

3. Show the Effects of Magnetism

Activities:

- a. Show, by demonstration, three things around the classroom which are affected by magnets.
- b. Show, by demonstration, three things around the classroom which are not affected by magnets.
- c. Using iron filings, prove the existence of magnetic lines of force.
- d. Prove that in magnets, like poles repel and opposite poles attract.

Materials:

Magnets, iron filings

EVALUATION:

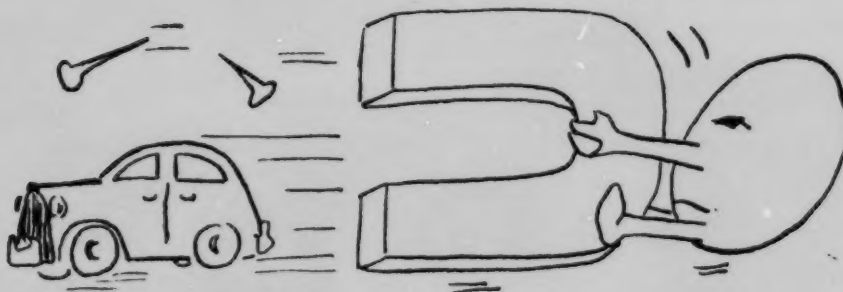
1. Have your instructor check your demonstration on the effects of magnets.
2. Answer the five questions on magnets and magnetism which are found on the work sheet. Submit this completed sheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Groneman, Chris H. and Feirer, John L. General Industrial Education. McGraw-Hill Book Company, New York, New York, 1974.

Newkirk, Louis V. General Shop for Everyone. D. C. Heath and Co., Boston, Mass., 1967.

Williams, Gerald E. Electricity and Electronics. American Technical Society, Chicago, Illinois, 1979.



WORKSHEET

1. The major types of magnets are:

2. Three principles of magnetism are:

3. Answer these questions:

A. What is magnetism?

B. How do you make an electromagnet?

C. What happens to the magnetic field if we break a magnet into two pieces?

D. What is a lodestone?

E. What is a temporary magnet? A permanent magnet?

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT ELECTRICITY/ELECTRONICS

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying the Types of Magnets					
Discussing the Principles of Magnetism					
Showing the Effects of Magnetism					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 12

UNIT: Electricity/Electronics

OCCUPATIONAL COMPETENCY: Describe Batteries and their Operation

LEARNING OBJECTIVES:

1. Identify the Different Types of Batteries

Activities:

- a. Read pages 454-457 in General Industrial Education.
- b. Read pages 24-29 in Basic Electricity.
- c. Name the different types of batteries on the work sheet provided and relate where they might be used.

Materials:

Assortment of batteries

2. Identify the Different Parts of a Battery

Activities:

- a. Observe the diagrams on pages 24-29 in Basic Electricity.
- b. Listen to a presentation on how a dry cell works.
- c. Draw a diagram of a dry cell and label the parts on the work sheet provided.

Materials:

None

3. Discuss the Operation of a Battery

Activities:

- a. Read pages 24-29 in Basic Electricity.
- b. Listen to a presentation on how a storage battery works.
- c. On the work sheet provided, draw a diagram of a storage battery and label the parts.

Materials:

None

EVALUATION:

1. Answer the four questions on batteries which are found on the work sheet. Submit this completed work sheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Groneman, Chris H. and Feirer, John L. General Industrial Education. McGraw-Hill Book Co., New York, New York, 1974.

Van Valkenburgh, Nooger and Neville, Inc. Basic Electricity. John F. Rider Publisher, Inc., New York, New York, 1954.



WORKSHEET

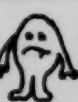
1. The different types of batteries and their uses are:
2. Draw a dry cell and label its parts.
3. Draw a storage battery and label its parts.
4. Answer these questions:
 - A. What kind of electrical current is produced by a battery?
 - B. What is a primary cell? A secondary cell?
 - C. Why are there two terminals on a battery?
 - D. How many cells does a 12 volt car battery have?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT ELECTRICITY/ELECTRONICS

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying the Different Types of Batteries					
Identifying the Different Parts of a Battery					
Discussing the Operation of a Battery					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 13

UNIT: Electricity/Electronics

OCCUPATIONAL COMPETENCY: Connect Electrical Wiring

LEARNING OBJECTIVES:

1. Fasten Electrical Wires Together

Activities:

- a. Read pages 451-452 in General Industrial Education.
- b. Read pages 9-10 in Electricity and Electronics.
- c. Practice splicing two, three and four wires together.
- d. Fasten two wires together using a wire nut.
- e. Name three types of splices.

Materials:

Wire, wire nuts, needle nose pliers, wire stripper, wire cutter, electrician's tape

2. Solder Electrical Wires Together

Activities:

- a. Read Unit 4, pages 8-10, in Electricity and Electronics.
- b. Watch a demonstration on good soldering techniques.
- c. Fasten two wires together in a good mechanical joint as practiced above.
- d. Solder the wires together as shown in demonstration. Practice.

Materials:

Wire, needle nose pliers, soldering iron, solder, asbestos board

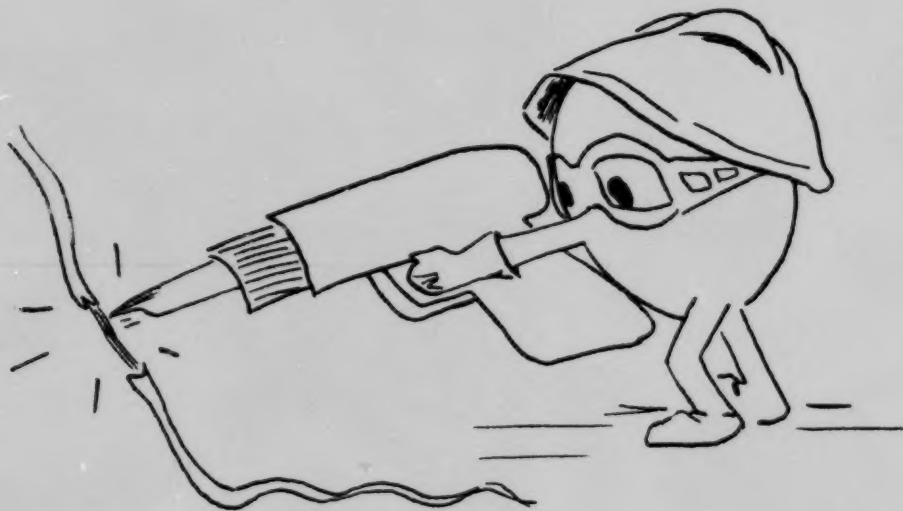
EVALUATION:

1. Have the instructor evaluate your wire splices and soldered joints for correct technique.
2. Complete the attitude sheet.

RESOURCES:

Groneman, Chris H. and Feirer, John L. General Industrial Education. McGraw-Hill Book Co., New York, New York, 1974.

Williams, Gerald E. Electricity and Electronics. American Technical Society, Chicago, Illinois, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT ELECTRICITY/ELECTRONICS

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Fastening Electrical Wires Together					
Soldering Electrical Wires Together					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 14

UNIT: Electricity/Electronics

OCCUPATIONAL COMPETENCY: Use Ohm's Law

LEARNING OBJECTIVES:

1. Define Voltage, Current and Resistance

Activities:

- a. Read Unit 11, pages 29-32, in Electricity and Electronics.
- b. On the work sheet provided, name and define the three elements of electricity.
- c. Define ohm, ampere and volt on the work sheet provided.

Materials:

None

2. Discuss the Relationship of Voltage, Current and Resistance as Given in Ohm's Law

Activities:

- a. Read Unit 12, pages 33-35, in Electricity and Electronics.
- b. On the work sheet provided, tell how voltage, current and resistance are related in electrical circuits (Ohm's Law).

Materials:

None

EVALUATION:

1. Answer the three questions provided on the work sheet and submit the completed work sheet to the instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. American Technical Society, Chicago, Illinois, 1979.

WORKSHEET

1. The three elements of electricity are:

2. Definitions:

Ohm -

Ampere -

Volt -

3. Ohm's Law is:

4. Answer these questions:

A. Using Ohm's Law, tell how many volts will an appliance need if it has 7 ohms and 2 amps.

B. How many amps will an appliance draw if it has 10 volts and 5 ohms?

C. How many ohms will an appliance have if it has 100 volts and 3 amps.

STUDENT ATTITUDE SHEET

for

CLUSTER

MANUFACTURING

UNIT

ELECTRICITY/ELECTRONICS

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Defining Voltage, Current and Resistance					
Discussing the Relationship of Voltage, Current and Resistance as Given in Ohm's Law					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 15

UNIT: Electricity/Electronics

OCCUPATIONAL COMPETENCY: Describe Series and Parallel Circuits

LEARNING OBJECTIVES:

1. Identify Series and Parallel Circuits

Activities:

- a. Read Unit 15, pages 40-42, in Electricity and Electronics.
- b. Read Unit 16, pages 43-44, in Electricity and Electronics.
- c. Read Unit 17, pages 45-47, in Electricity and Electronics.
- d. Observe drawings of electrical circuits and identify whether they are series or parallel.
- e. Observe actual wired circuits and identify whether they are series or parallel.

Materials:

Assortment of electric circuit drawings, assortment of wired electric circuits

2. Describe the Characteristics of Series and Parallel Circuits

Activities:

- a. Wire a circuit with three light bulbs in series and connect it to a suitable power source.
- b. Wire a circuit with three light bulbs in parallel and connect it to a suitable power source.
- c. Answer these questions:
 - (1) Why are the light bulbs in one circuit brighter than in the other.
 - (2) What happens when you remove a light bulb from each circuit? Why?

Materials:

Light bulbs, sockets, wire, power cord

EVALUATION:

1. Have the instructor check your wired circuits and submit the answers to the questions for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. American Technical Society, Chicago, Illinois, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT ELECTRICITY/ELECTRONICS

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Series and Parallel Circuits					
Describing the Characteristics of Series and Parallel Circuits					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

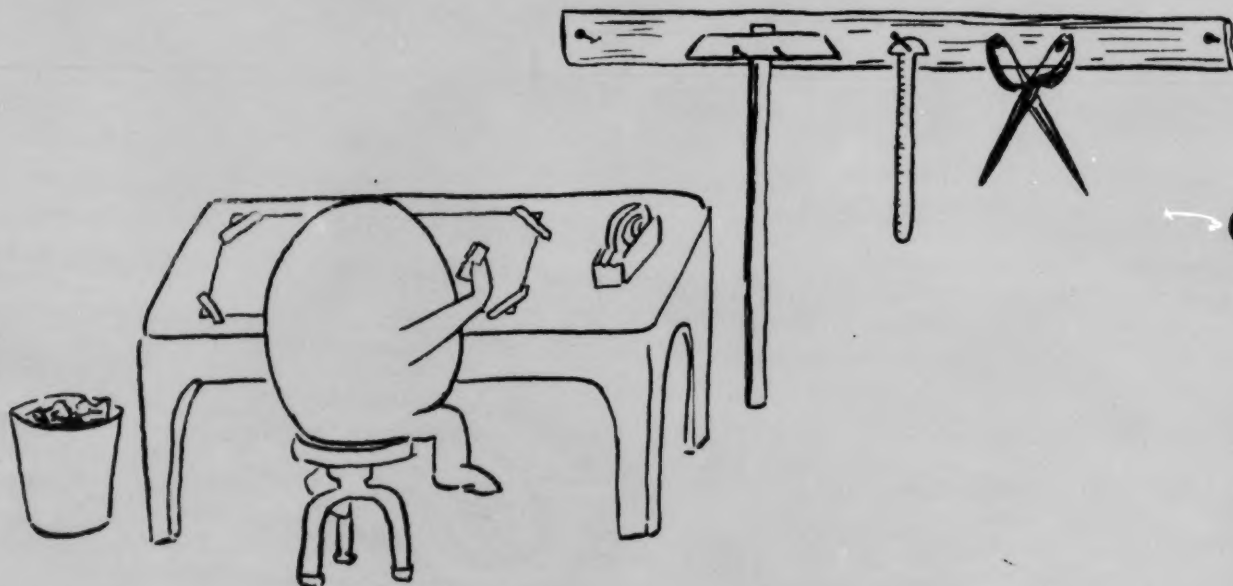
UNIT OF STUDY: Layout and Design Artist

DOT OCCUPATIONAL CATEGORY: Professional, Technical and Managerial

DOT OCCUPATIONAL DIVISION: Art

DOT OCCUPATIONAL GROUP: Commercial Artists: Designers and Illustrators, Graphic Arts

OCCUPATIONAL OVERVIEW: The layout and design artist designs art and copy layouts for material to be presented by visual communications media such as books, magazines, newspapers, television and packaging. Plans presentation of material, determines size and arrangement of art and text, selects style of type and inspects final layouts. May specialize in a particular field, medium or type of layout.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

141.061-018	Graphic Designer
141.031-010	Art Director
141.061-022	Illustrator
141.081-014	Commercial Designer
979.131-010	Supervisor, Publications Production

LESSON 1

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Identify and Select a Type Face

LEARNING OBJECTIVES:

1. Describe the Major Styles of Type

Activities:

- a. Read pages 6 to 7 in Printing Layout and Design.
- b. Watch a demonstration on the main styles of type and their use.
- c. Look at an assortment of type styles and identify each.
- d. Tell what type style your book is printed in.
- e. Define "serif".

Materials:

Assortment of type styles

2. Describe a Type Family

Activities:

- a. Read page 115 in Printing Layout and Design.
- b. Watch a demonstration on type families.
- c. Look at an assortment of type family faces and identify each.
- d. On the worksheet, identify type family faces.

Materials:

Assortment of type family faces

3. Select a Type Style for a Job

Activities:

- a. Read pages 34 to 35 in Graphic Arts/Kagy.

- b. Read page 62 in Printing Layout and Design.
- c. Watch a demonstration on how to select the right type style for a job.
- d. Define "appropriate type faces".
- e. Look at some advertisements and observe the type faces.

Materials:

Advertisements

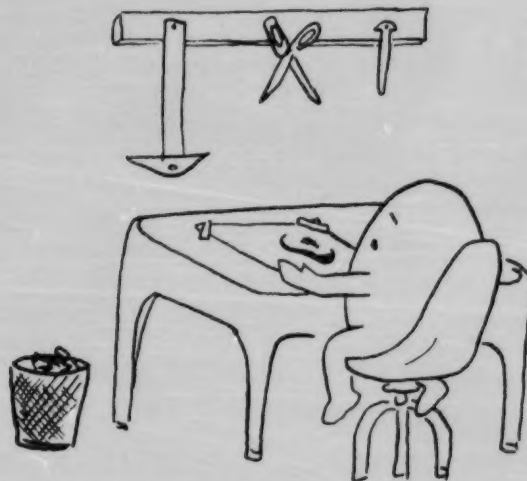
EVALUATION:

- 1. For a poster described by the instructor, select an appropriate type face and hand letter the full-size words for the title. Defend your selection.
- 2. Complete the worksheet and submit it to your instructor for evaluation.
- 3. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.

Kagy, Frederick D. Graphic Arts. South Holland, Illinois, Goodheart-Willcox Co., Inc. 1970.



WORKSHEET

1. Identify the following styles of type:

STYLE

a. _____

Style

b. _____

STYLE

c. _____

2. Identify the following families of type.

FAMILY

a. _____

FAMILY

b. _____

FAMILY

c. _____

FAMILY

d. _____

FAMILY

e. _____

3. Describe a feminine type style and a masculine type style and tell where they would be found.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Major Styles of Type					
Finding-Out About Type Families					
Selecting Type Styles for a Job					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Arrange One Word on a Page

LEARNING OBJECTIVES:

1. Prepare a Well Proportioned Page

Activities:

- a. Read page 10 in Printing Layout and Design.
- b. Watch a demonstration on laying-out a well proportioned page.
- c. Define "Regular Oblong".
- d. Compute the width of a page if its length is 12 inches.

Materials:

Pencil, paper

2. Identify the Correct Way to Place One Word on a Page

Activities:

- a. Read page 11 in Printing Layout and Design.
- b. Watch a demonstration on how to place one word on a page.
- c. Define "line of golden proportion".
- d. Practice sketching a well proportioned page and locating a one-word title on it.

Materials:

Paper, pencil

EVALUATION:

1. Assume you are designing a cover for a school play. Find the length of the sheet if the width is 6 inches. Then draw the page and place the word PROGRAM in the best spot. Submit your completed layout to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Laying-Out a Well Proportioned Page					
Placing One Word on a Page					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Arrange Several Groups of Words on a Page

LEARNING OBJECTIVES:

1. Prepare a Well Proportioned Page with the Golden Oblong

Activities:

- a. Read page 13 in Printing Layout and Design.
- b. Watch a demonstration on how to layout a page using the Golden Oblong.
- c. Review page layout with the Regular Oblong.
- d. Define "Golden Oblong".
- e. Compute the width of a Golden Oblong page layout if its length is 15 inches.

Materials:

Pencil, paper

2. Demonstrate Shape Harmony in Page Layout

Activities:

- a. Read page 15 in Printing Layout and Design.
- b. Watch a demonstration on how to shape type groups to look good on a page layout.
- c. Practice sketching page layouts and shaping type groups to look good.

Materials:

Pencil, paper

3. Show How to Layout Two Groups of Type on a Page

Activities:

- a. Read pages 15 to 16 in Printing Layout and Design.

- b. Watch a demonstration on how to layout two groups of type on a page.
- c. Describe how to locate two groups of type on a page.
- d. Practice sketching a page and locating two groups of type.

Materials:

Pencil, paper

EVALUATION:

1. On a 6" x 10" menu cover, arrange the words Home Made Dinners and Larson Cafe in a pleasing manner. You should select a nice size and style of type for this cover and submit the completed layout to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using the "Golden Proportion" in Layout					
Showing Shape Harmony in Layout					
Laying-Out Two Groups of Type					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Arrange a Page with Several Cuts

LEARNING OBJECTIVES:

1. Discuss the Main Units in Advertising Layout

Activities:

- a. Read pages 17 to 18 in Printing Layout and Design.
- b. Watch a demonstration identifying the main units in advertising layout.
- c. Name the four main units in advertising layouts and tell their function.
- d. Sketch a simple advertisement for a local store using the four main units of advertising layouts.

Materials:

Pencil, paper

2. Describe the Method for Laying Out Several Cuts

Activities:

- a. Read pages 28 to 30 in Printing Layout and Design.
- b. Watch a demonstration on how to arrange several cuts on a layout.
- c. Name the letters which form good designs for laying out cuts.
- d. Practice laying out several cuts by sketching a page and drawing blocks to show the location of cuts.

Materials:

Pencil, paper

EVALUATION:

1. Layout the following copy and submit the completed project to your instructor for evaluation:

Size: 8½" x 11" deep
 Display Head: 100% American Made
 Text: The copy would be written after the layout has been finished. Using double lines, simply mark where text will be located later.
 Large Cut: 3" x 6" deep
 Circular Cut: 2" in diameter
 Small Cuts: (Two) 1" x 1½" deep
 Signature: Remington Firearms

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Main Units in Advertising Layout					
Seeing How to Layout Several Cuts					
Arranging a Page Layout With Several Cuts					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Position Margins and Borders

LEARNING OBJECTIVES:

1. Layout the Margins for a Single Printed Page

Activities:

- a. Read pages 33 to 34 in Printing Layout and Design.
- b. Watch a demonstration on laying out margins on a single printed page.
- c. Explain how to layout a margin.
- d. Practice laying out a margin by sketching a page and arranging simple text material on it.

Materials:

Pencil, paper

2. Layout the Margins for Book Pages

Activities:

- a. Read pages 35 to 37 in Printing Layout and Design.
- b. Watch a demonstration on laying out the margins for a book.
- c. Explain two methods to layout the margins for a book.

Materials:

None

3. Locate a Border Around a Unit of Type

Activities:

- a. Read pages 45 to 47 in Printing Layout and Design.
- b. Read pages 38 to 39 in Printing Layout and Design.

- c. Watch a demonstration on locating a border around a unit of type.
- d. Describe two styles of borders.
- e. Describe the correct method for locating a border around a unit of type.
- f. Practice locating a border by sketching a page and drawing a unit of type in the correct position. Locate a border.

Materials:

Pencil, paper

EVALUATION:

1. Arrange a pleasing composition for a construction company advertisement provided by the teacher. Make sure the margins are correct and place a border around the page. Submit the completed layout to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Laying-Out the Margins for a Single Page					
Laying-Out the Margins for Book Pages					
Locating a Border Around a Unit of Type					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Design a Business Card

LEARNING OBJECTIVES:

1. Describe the Main Considerations in the Layout of a Business Card

Activities:

- a. Read page 40 in Printing Layout and Design.
- b. Watch a demonstration on considerations for the layout of a business card.
- c. List some considerations for the layout of a business card.

Materials:

None

2. List the Most Common Sizes of Business Cards

Activities:

- a. Read page 41 in Printing Layout and Design.
- b. Watch a demonstration on the most common sizes of business cards.
- c. List the most common sizes of business cards.

Materials:

None

EVALUATION:

1. Select a proper size and design a business card for the following copy:

Keystone Appliance Co.
Maytag Washers and Dryers
Sales and Service
Middletown, W.V. 26554
Martin C. Roberts

Add cuts and/or text as you feel necessary to complete the layout. Submit the finished card to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What to Consider to Layout a Business Card					
Learning What Sizes Business Cards Come In					
Designing a Business Card					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Demonstrate Eye Movement Through a Layout

LEARNING OBJECTIVES:

1. Use Pointing Devices in an Advertisement Layout

Activities:

- a. Read pages 51 to 52 in Printing Layout and Design.
- b. Watch a demonstration on the use of pointing devices in an advertisement layout.
- c. List some things which can be used as pointing devices in a layout.
- d. Practice using pointing devices by sketching an advertisement for an umbrella sale at a local store.

Materials:

Pencil, paper

2. Discuss Eye Movement Through the Main Units of a Layout

Activities:

- a. Read page 53 in Printing Layout and Design.
- b. Watch a demonstration on the importance of eye movement through the main units of a layout.
- c. Discuss how the eye should move through a layout.

Materials:

None

3. Direct Eye Movement Through a Layout

Activities:

- a. Read pages 54 to 55 in Printing Layout and Design.

- b. Watch a demonstration on how to direct eye movement through a layout.
- c. Discuss how to direct eye movement through a layout.
- d. Practice directing eye movement through a layout by sketching an advertisement for a Florida vacation. Sketch cuts, text, etc.

Materials:

Pencil, paper

EVALUATION:

1. Read the following copy, select the main units, identify potential pointing devices and complete the layout:

Size: 7" x 10" deep
Display Head: The Exciting Cordoba
Cut: 3" x 4"
Subhead: Five New Styles
Text: No definite amount of text
Small Cut: 1½" diameter
Signature: Chrysler Motors

Submit the final layout to the instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using Pointing Devices in an Advertisement Layout					
Directing Eye Movement Through a Layout					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Design a Letterhead

LEARNING OBJECTIVES:

1. Describe the Main Considerations in the Design of a Letterhead

Activities:

- a. Read page 65 in Printing Layout and Design.
- b. Watch a demonstration on the main considerations in the design of a letterhead.
- c. List the main considerations in the design of a letterhead.
- d. Look at some letterheads and observe their layout.

Materials:

Letterheads

2. Demonstrate Eye Movement in a Letterhead

Activities:

- a. Read page 66 in Printing Layout and Design.
- b. Watch a demonstration on how to direct eye movement in a letterhead.
- c. Sketch the right way and the wrong way to arrange a letterhead.

Materials:

Pencil, paper

EVALUATION:

1. Arrange the following letterhead:

Size: 8½" x 11"
Copy: The Smith and Jones Company
Foreign and Domestic Sales
1100 American Blvd.
New York, New York

Complete the letterhead and submit it to the instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What to Consider in Designing a Letterhead					
Demonstrating Eye Movement in a Letterhead					
Designing a Letterhead					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Place a Trademark on a Letterhead

LEARNING OBJECTIVES:

1. Describe the Use and Location of a Trademark on a Letterhead

Activities:

- a. Read pages 103 to 104 in Printing Layout and Design.
- b. Watch a demonstration on the use and location of a trademark on a letterhead.
- c. Tell the use of a trademark.
- d. List some locations for trademarks.

Materials:

None

2. Design a Simple Trademark

Activities:

- a. Watch a demonstration on designing a good trademark.
- b. Practice designing trademarks by selecting a local business and creating appropriate ornament.
- c. Look at the trademarks of businesses in your area and observe their style.

Materials:

Pencil, paper

EVALUATION:

1. Layout the following letterhead and add a properly designed trademark:

Size: 8½" x 11"
Copy: Gates Studio
Commercial Photography
810 King Street
Lancaster, Ohio

Submit the finished letterhead to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc., 1968.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Discovering the Use of Trademarks					
Designing Trademarks					
Designing Letterhead with Trademarks					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Layout and Design Artist

OCCUPATIONAL COMPETENCY: Demonstrate Continuity in Business Forms

LEARNING OBJECTIVES:

1. Discuss the Main Considerations in Laying Out Similar Designs in Business Forms

Activities:

- a. Read pages 106 to 107 in Printing Layout and Design.
- b. Watch a demonstration on the considerations in laying out similar designs in business forms.
- c. List the considerations in laying out similar designs in business forms.
- d. Practice laying out similar designs in business forms by selecting a local store and sketching business forms for it.

Materials:

Pencil, paper

2. List the Standard Sizes of Letterheads, Bill Heads, Statements, and Envelopes

Activities:

- a. Read pages 108 to 109 in Printing Layout and Design.
- b. Watch a demonstration on standard sizes of letterheads, bill heads, statements, and envelopes.
- c. List the standard sizes of letterheads, bill heads, statements, and envelopes.

Materials:

Pencil, paper

EVALUATION:

1. Select appropriate sizes for a letterhead, envelope, bill head, and business card and layout a similar design for each, using the following copy:

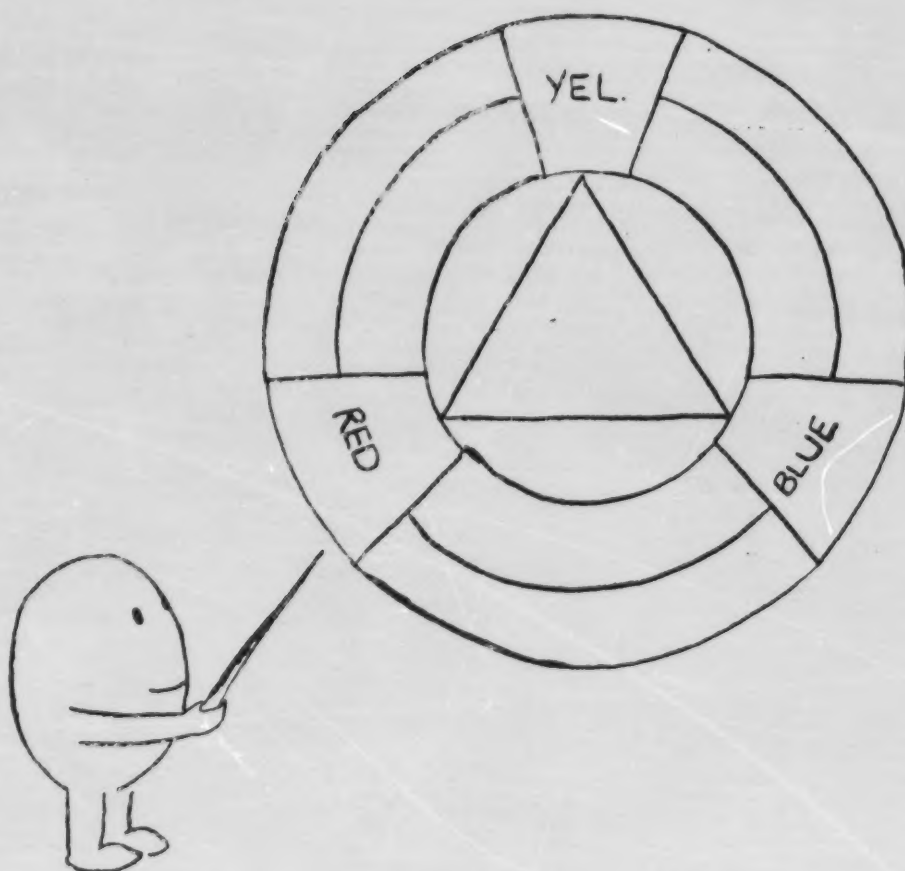
B. L. Mathews Publishing Company
621 Lexington Avenue
Buena Vista, California 61603

Complete the business forms and submit them to your instructor
for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Printing Layout and Design. Albany, New York, Delmar Publishers, Inc.,
1968



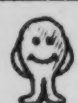
NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT LAYOUT AND DESIGN ARTIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Sizes of Letterheads, Bill Heads, Statements and Envelopes					
Designing Business Forms with Some Continuity					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

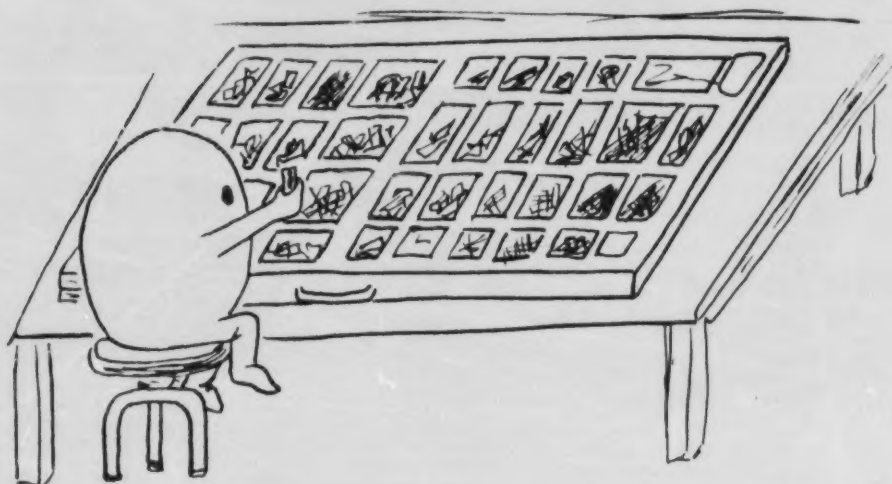
UNIT OF STUDY: Graphic Arts Compositor

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Graphic Arts Work

DOT OCCUPATIONAL GROUP: Hand Compositors, Typesetters and Related Occupations

OCCUPATIONAL OVERVIEW: The graphic arts compositor sets type by hand or machine, assembles type and cuts in a galley for printing articles, headings and other text and determines size, style and composition pattern from work order. Selects and composes type, prepares proof copy of set-up and examines for errors. Cleans type after use and returns to type case.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

973.381-010	Compositor
973.381-018	Job Printer
973.381-026	Make-Up Arranger
650.582-010	Linotype Operator
650.582-018	Photocomposing Machine Operator
203.382-018	Magnetic-Tape-Composer Operator
203.382-026	Varitype Operator

LESSON 1

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Discuss Foundry Type

LEARNING OBJECTIVES:

1. Identify Type Characters and Their Use

Activities:

- a. Read pages 26 to 28 in Graphic Arts/Swerdlow.
- b. Read pages 8 to 11 in Graphic Arts/Kagy.
- c. Watch a demonstration on the different characters of hand set type.
- d. What is the height of hand set type?
- e. Look at the demons and practice identifying each.

Materials:

Hand set type font

2. Describe the System of Type Measurement

Activities:

- a. Read pages 16 to 17 in Graphic Arts/Swerdlow.
- b. Read pages 7 to 8 in Graphic Arts/Kagy.
- c. Watch a demonstration on how type is measured.
- d. Define pica and point.
- e. Use a line gauge and measure the height of some hand set type characters.
- f. Use a line gauge and measure the length of the lines of type on any page in your book.

Materials:

Line gauge

3. Discuss the System of Type Storage

Activities:

- a. Read pages 26 to 28 in Graphic Arts/Swerdlow.
- b. Read pages 9 to 11 in Graphic Arts/Kagy.
- c. Watch a demonstration on how type is stored in the California type case.
- d. Explain why there are more of some letters than others.
- e. Tell why the letters in the California type case are not arranged alphabetically.
- f. Look at the California type case and practice locating type characters.

Materials:

California type case

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

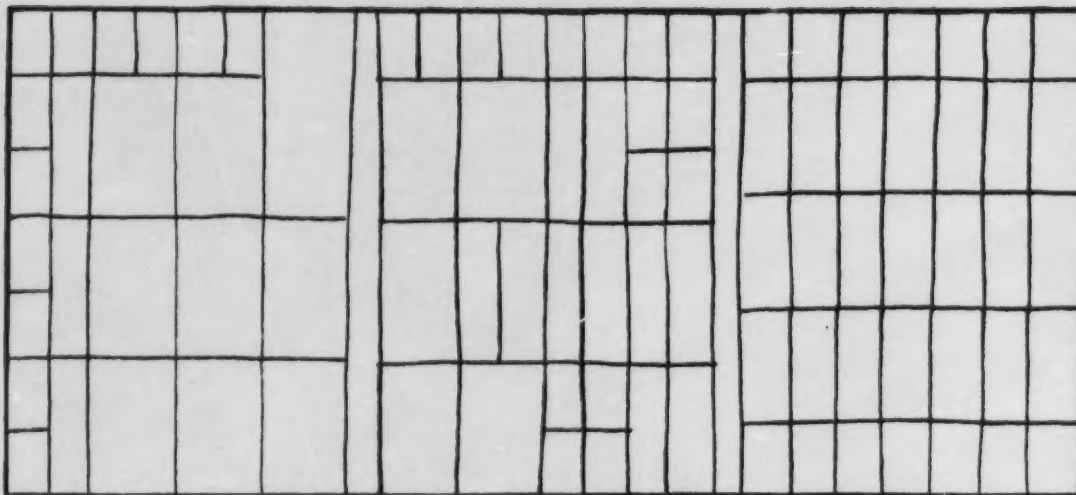
RESOURCES:

Kagy, Frederick D. Graphic Arts. South Holland, Illinois, The Goodheart-Willcox Co., Inc., 1970.

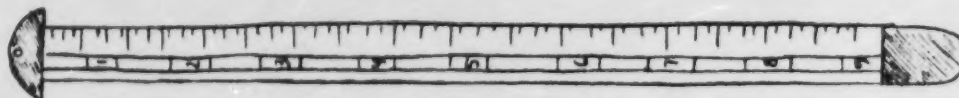
Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

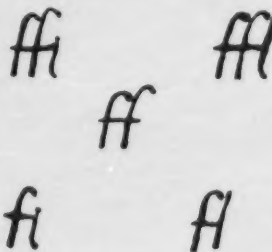
1. Show where hand set type is stored by filling in the following California type case:



2. Identify this tool:



3. What are these characters called? What are they used for?



4. Identify the following spaces and quads:

a. _____



e. _____

b. _____

a.

b.

c.

d.

e.

f.

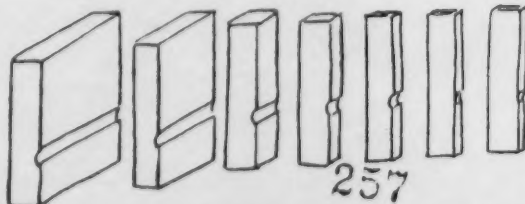
g.

f. _____

c. _____

d. _____

g. _____



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Type Characters					
Measuring Type					
Using the California Job Case					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Compose a Simple Form

LEARNING OBJECTIVES:

1. Identify the Tools and Supplies Needed to Set Foundry Type

Activities:

- a. Read page 29 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the tools and supplies needed to set type.
- c. Practice setting a composing stick to different length lines.
- d. Define lead and slug.

Materials:

None

2. Perform the Steps in Hand Setting Foundry Type

Activities:

- a. Read pages 30 to 31 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to hand set foundry type.
- c. On the worksheet, explain how type is set in a composing stick.
- d. Practice setting type in the composing stick.

Materials:

Font of hand-set type, composing stick

EVALUATION:

1. Using a type face of your choosing, set the following copy flush left on a 15 pica line:

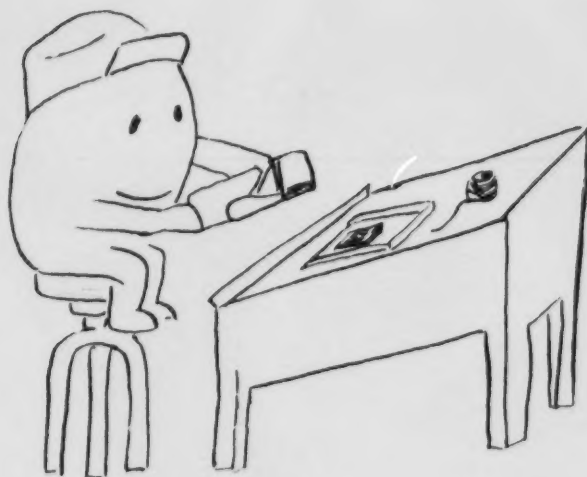
The printer's system of measurement is called the point system. An inch is divided into seventy-two parts called points. A pica equals twelve points.

Submit your completed type form to your instructor for evaluation on accuracy, spacing and spelling.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

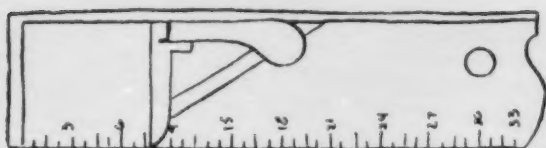
Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



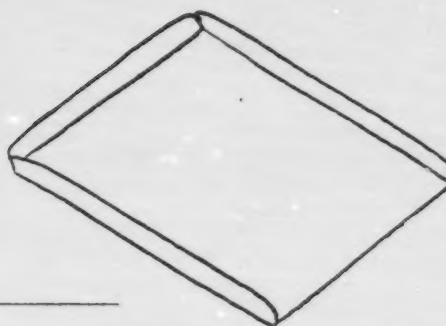
WORKSHEET

1. Explain how to set type in a composing stick.

2. Identify this equipment:



a. _____



b. _____

3. Define the following terms:

Flush Left

Flush Right

Centered

Justified

4. TRUE or FALSE. Always begin hand-setting type by first inserting a lead into the composing stick.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Composition Tools					
Setting Type Flush Left					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Pull a Proof

LEARNING OBJECTIVES:

1. Prepare the Type Form for Proofing

Activities:

- a. Read pages 38 to 39 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to prepare the type form for proofing.
- c. Practice dumping a type form onto a galley and tying it with string.

Materials:

Type form, galley, string, lead

2. Outline the Steps for Pulling a Proof

Activities:

- a. Read pages 39 to 41 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on pulling a proof.
- c. Practice inking a type form with a brayer.
- d. Practice operating the proof press.

Materials:

Type form, ink, brayer, proof press, paper, galley

3. Correct the Type Form

Activities:

- a. Read page 41 of Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to proofread and correct a type form.
- c. Practice proofreading composed material and making marks for correction.

Materials:

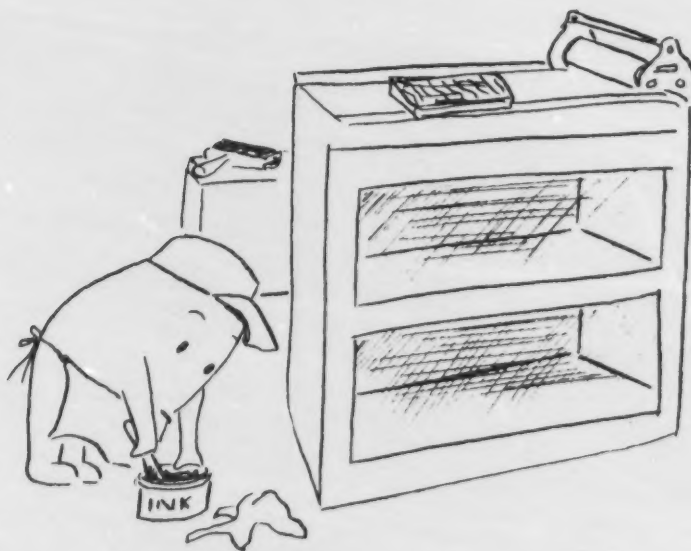
Composed material

EVALUATION:

1. Prepare two good proofs of the corrected type form composed in Lesson 2. Submit one proof to your instructor for evaluation and keep one for use in a later lesson.
2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Setting-Up for Proofing					
Proofing Hand-Set Type					
Correcting the Type Form After Proofing					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Center a Type Form

LEARNING OBJECTIVES:

1. Perform the Steps for Centering a Type Form

Activities:

- a. Read pages 31 to 32 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to center a hand set type form.
- c. Review Lesson 2.
- d. Practice inserting spacing material for centering a type form.

Materials:

Composing stick, hand set type font

EVALUATION:

1. Using a type face of your own choosing, compose and center the following copy on a 15 pica line:

(Your Name)
(Your Street Address)
(Your Town and State)
(Your Phone Number)

Pull a proof of the composition and correct any errors. Prepare two final proofs of the corrected form and submit one to your instructor for evaluation. Keep the other for use in a later lesson.

2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Centering a Type Form					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Justify a Type Form

LEARNING OBJECTIVES:

1. Perform the Steps for Justifying a Type Form

Activities:

- a. Read page 32 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to justify a hand set type form.
- c. Review Lesson 2.
- d. Practice computing word spacing for justifying a type form.

Materials:

Composing stick, hand set type font

EVALUATION:

1. Using a type face of your own choosing, compose and justify the following copy on a 15 pica line:

Type sizes are specified in points. Commonly used type sizes in composition are 6, 8, 10, 12, 14, 18, 24, 30, 36, 42, 48, 60, and 72 point. Type in sizes larger than 72 point are made of wood.

Pull a proof of the composition and correct any errors. Prepare two final proofs of the corrected form and submit one to your instructor for evaluation. Keep the other for use in a later lesson.

2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Justifying a Type Form					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Prepare Copy by Impact Composition

LEARNING OBJECTIVES:

1. Identify the Equipment and Supplies Needed for Impact Composition

Activities:

- a. Read page 54 in Photo Offset Fundamentals.
- b. Watch a demonstration on the equipment and supplies for impact composition.
- c. Identify the various kinds of impact composition equipment.
- d. On the worksheet, tell why it is important to use a one-time carbon ribbon.

Materials:

None

2. Perform the Steps for Composing Flush Left Copy on the Typewriter

Activities:

- a. Watch a demonstration on how to use the typewriter.
- b. Watch a demonstration on how to compose flush left copy.
- c. Practice using the typewriter and setting copy flush left.
- d. Define margin, tab and proportional spacing.
- e. Watch the movie: Type Right.

Materials:

Typewriter, paper

3. Perform the Steps for Composing Justified Copy on the Typewriter

Activities:

- a. Read pages 54 to 57 in Photo Offset Fundamentals.
- b. Watch a demonstration on composing justified copy on the typewriter.
- c. Practice composing justified copy on the typewriter.
- d. On the worksheet, explain how to compose justified copy on the typewriter.

Materials:

Typewriter

EVALUATION:

1. Using a typewriter, compose and justify the following copy on a 15 pica line:

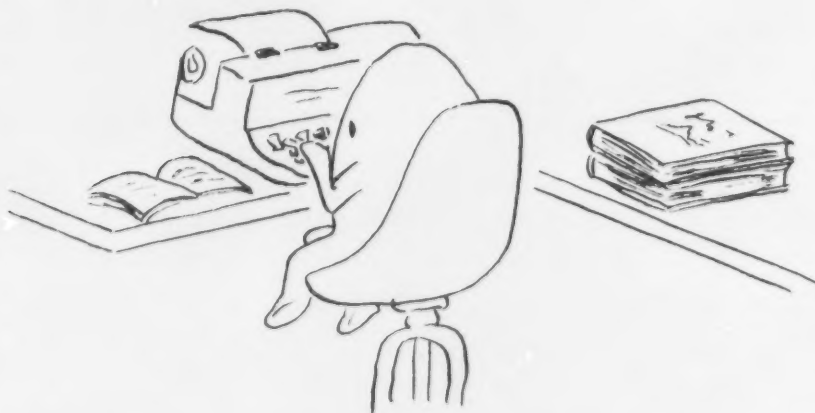
An example of hot type is hand-set foundry type. Examples of cold type include rub-on letters, typewriter copy and photographically composed text material.

Submit the final composition to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.



WORKSHEET

1. Identify this piece of equipment:



2. Explain how to compose justified copy on the typewriter.

3. How does the IBM Selectric typewriter differ from a normal one?

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Compose with the Typewriter					
Composing Justified Copy on the Typewriter					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Compose Display Type

LEARNING OBJECTIVES:

1. Identify the Parts of the Headliner

Activities:

- a. Watch a demonstration on the parts of the Headliner.
- b. Look at the Headliner and identify the main parts and their function.
- c. On the worksheet, name the parts of the Headliner.

Materials:

None

2. Outline the Operation of the Headliner

Activities:

- a. Read pages 74 to 75 in Photo Offset Fundamentals.
- b. Watch a demonstration on operating the Headliner.
- c. Explain how fonts of type are prepared for use on the Headliner.
- d. Practice using the Headliner to prepare sample copy.
- e. Define photo-composition.

Materials:

Headliner

EVALUATION:

1. Using the Headliner, compose the following display type:

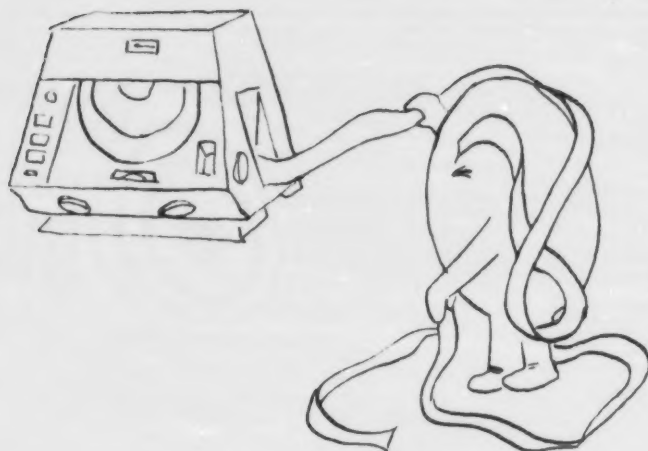
- A. THE POINT SYSTEM (24 point type)
- B. FOUNDRY TYPE (24 point type)
- C. GRAPHIC ARTS (48 point type)
- D. PRINTING (60 point type)

Submit the completed display type to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

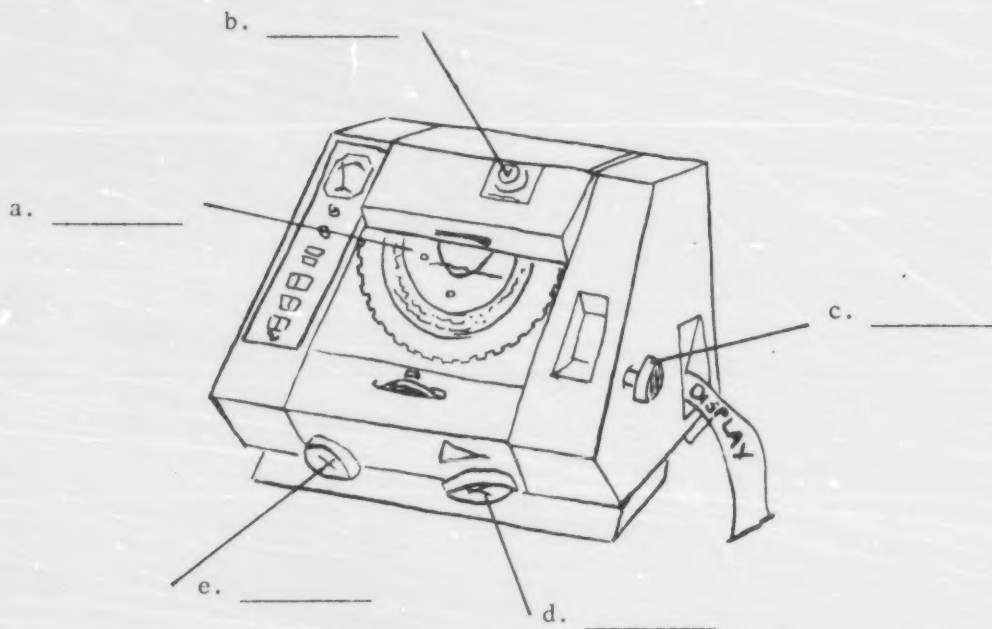
RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.



WORKSHEET

1. Name the parts of the Headliner:



2. TRUE or FALSE. The headliner is a photo-composition machine.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Discovering How to Operate the Headliner					
Setting Display Type with the Headliner					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Discuss Photo-Typesetting

LEARNING OBJECTIVES:

1. Discuss the Operation of the Intertype Fotosetter

Activities:

- a. Read pages 80 to 82 in Photo Offset Fundamentals.
- b. Watch a demonstration on how the Intertype Fotosetter operates.
- c. On the worksheet, tell how the Intertype Fotosetter operates.

Materials:

None

2. Discuss the Operation of the CRT Phototypesetter - Linotron 505

Activities:

- a. Read pages 93 to 94 in Photo Offset Fundamentals.
- b. Watch a demonstration on how the CRT Phototypesetter - Linotron 505 operates.
- c. On the worksheet, tell how the CRT Phototypesetter - Linotron 505 operates.

Materials:

None

3. Discuss the Operation of the Harris 1500

Activities:

- a. Read pages 98 to 99 in Photo Offset Fundamentals.
- b. Watch a demonstration on how the Harris 1500 operates.
- c. On the worksheet, tell how the Harris 1500 operates.

Materials:

None

EVALUATION:

1. Answer the questions on the worksheet and submit the completed form to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.

WORKSHEET

1. Tell how the Intertype Fotosetter operates.

2. Tell how the CRT Phototypesetter - Linotron 505 operates.

3. Tell how the Harris 1500 operates.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How the Intertype Fotosetter Works					
Learning How the CRT Phototypesetter-Linotron 505 Works					
Learning How the Harris 1500 Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Compose a Form with Existing Printed Material

LEARNING OBJECTIVES:

1. Demonstrate the Use of Clip Art

Activities:

- a. Read pages 50 to 51 in Photo Offset Fundamentals.
- b. Watch a demonstration on how to use clip art.
- c. Look through a clip art book and become familiar with what is available.

Materials:

Clip art book

2. Demonstrate the Use of Pre-Printed Type

Activities:

- a. Read pages 51 to 54 in Photo Offset Fundamentals.
- b. Watch a demonstration on the use of pre-printed type.
- c. Practice using rub-on letters and symbols.

Materials:

Rub-on letters and symbols

3. Demonstrate Hand Lettering

Activities:

- a. Read pages 49 to 50 in Photo Offset Fundamentals.
- b. Watch a demonstration on the use of hand lettering aids and devices.
- c. Practice using lettering templates, lettering instruments and speedball pens.

Materials:

Templates, lettering instruments, speedball pens

EVALUATION:

1. For an advertisement or poster of your own choosing, compose a "mechanical" employing clip art, pre-printed type and hand drawn letters and lines. Submit the final layout to your instructor for evaluation on neatness, layout and accuracy.
2. Complete the attitude sheet.

RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using Clip Art					
Using Pre-Printed Type					
Composing a Mechanical With Cold Type					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Graphic Arts Compositor

OCCUPATIONAL COMPETENCY: Do a Paste-Up

LEARNING OBJECTIVES:

1. Prepare a Paste-Up

Activities:

- a. Read pages 74 to 76 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to paste-up material for camera-ready copy.
- c. Name two methods of mounting the elements of the layout to the base.
- d. Practice pasting-up elements for display.

Materials:

Paper, rubber cement, composition material

EVALUATION:

1. Make a paste-up using a theme of "Graphic Arts Composition". To prepare the paste-up, use examples of composed materials from Lessons 2, 4, 5, 6, 7, and/or 9. Submit the finished paste-up to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS COMPOSITOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Paste-Ups					
Making a Paste-Up From Your Own Printed Material					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

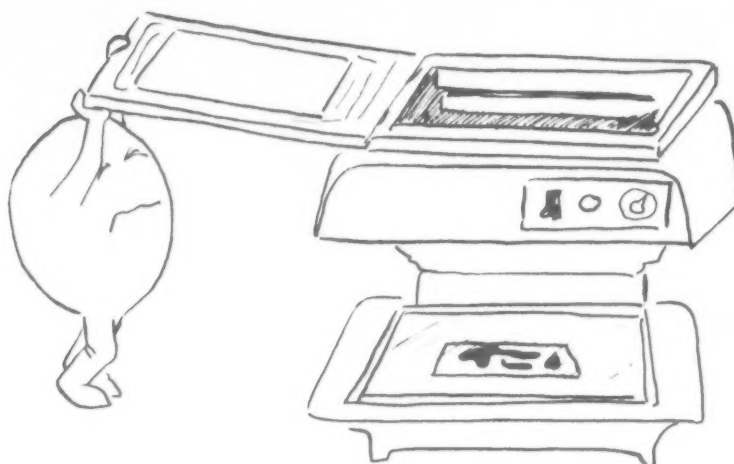
UNIT OF STUDY: Graphic Arts Photographer

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Graphic Arts Work

DOT OCCUPATIONAL GROUP: Lithographers and Related Occupations

OCCUPATIONAL OVERVIEW: The graphic arts photographer sets up and operates a process camera to photograph illustrations and printed material and produce film negatives or positives used in the preparation of printing plates. Makes single copies, half-tones, four color separations, duotones, etc. Develops film by hand or places it in an automatic processor.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

972.382-014	Photographer, Lithographic
972.664-010	Litho-Make-Ready Assistant
971.381-022	Photolith Operator
976.361-010	Reproduction Technician
976.681-010	Developer

LESSON 1

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Discuss Basic Principles of Graphic Arts Photography

LEARNING OBJECTIVES:

1. Name and Describe the Three Forms of Copy

Activities:

- a. Read pages 110 to 111 in Photo Offset Fundamentals.
- b. Watch a demonstration on the three forms of graphic arts copy.
- c. Look at an assortment of pictures, graphs, illustrations, etc., and determine the copy form of each.
- d. On the worksheet, identify forms of copy.
- e. Watch the movie: High Contrast Photography for Instruction.

Materials:

Assortment of copy forms

2. Discuss the Film Used in the Graphic Arts Darkroom

Activities:

- a. Read pages 124 to 125 in Photo Offset Fundamentals.
- b. Watch a demonstration on line film and its use in the graphic arts darkroom.
- c. Describe line film.
- d. Name a graphic arts line film.
- e. Look at a line negative and observe the clear and black areas.

Materials:

Line negative

3. Name the Two Types of Process Cameras and Identify Their Parts

Activities:

- a. Read pages 125 to 133 in Photo Offset Fundamentals.
- b. Watch a demonstration on the two types of process cameras.
- c. Look at a process camera and identify its main parts.
- d. On the worksheet, identify the two types of process cameras.

Materials:

Process camera

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. (3rd edition) Bloomington, Illinois, McKnight Publishing Co., 1973.



WORKSHEET

1. Identify the following forms of copy:



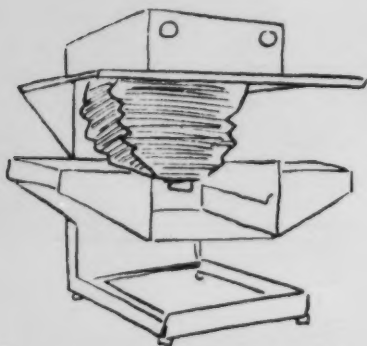
a. _____

b. _____

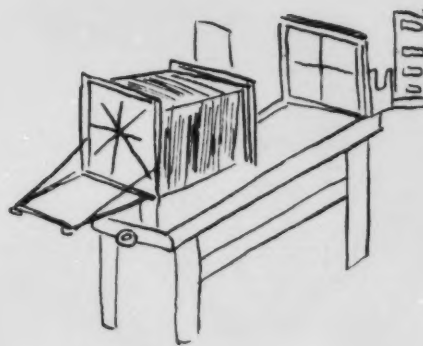
c. _____

d. _____

2. Identify the following types of process cameras:



a. _____



b. _____

3. Define "high contrast film."

4. TRUE or FALSE. The emulsion is the light-sensitive part of graphic arts film.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Three Forms of Copy					
Seeing What Film is Used in the Graphic Arts Darkroom					
Finding-Out What Cameras Are Used					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Expose a Line Negative

LEARNING OBJECTIVES:

1. Describe How to Handle Copy to be Exposed in the Process Camera

Activities:

- a. Read pages 11 to 14 in Basic Photography for the Graphic Arts.
- b. Read pages 113 to 114 in Photo Offset Fundamentals.
- c. Watch a demonstration on handling copy material for exposure.
- d. Practice placing the copy on the copyboard of the process camera.
- e. Watch the slide/tape show: Line Photography.

Materials:

Copy, process camera

2. Set Up the Process Camera to Expose a Line Negative

Activities:

- a. Read pages 133 to 137 in Photo Offset Fundamentals.
- b. Watch a demonstration on how to operate the process camera.
- c. Practice changing the bellows and copy controls on the camera.
- d. Practice changing f-stop and shutter controls.
- e. Using scrap film, practice exposing line film to copy.

Materials:

Process camera, line film, copy

EVALUATION:

1. Using line copy provided by the instructor, expose a sheet of high contrast ortho film in the process camera at 100% reproduction size. If film processing is not provided, wait until the completion of Lesson 3 to finish this assignment.

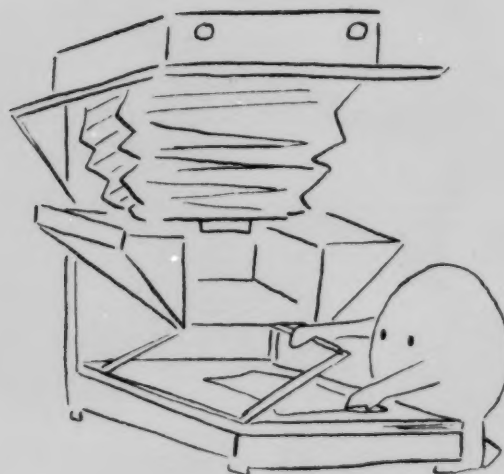
Submit the completed line negative to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Basic Photography for the Graphic Arts. Rochester, New York, Eastman Kodak Co., 1972.

Cogoli, John E. Photo Offset Fundamentals. (3rd edition) Bloomington, Illinois, McKnight Publishing Co., 1973.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Expose a Line Negative					
Setting-Up the Process Camera					
Exposing a Line Negative					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Develop a Line Negative

LEARNING OBJECTIVES:

1. List the Equipment Used in Developing a Line Negative

Activities:

- a. Read page 15 in Basic Photography for the Graphic Arts.
- b. Read pages 208 to 210 in Photo Offset Fundamentals.
- c. Watch a demonstration on the equipment needed to develop a line negative.
- d. From an assortment of film developing equipment, identify each item and its use.
- e. On the worksheet, identify film developing equipment.

Materials:

Assortment of film developing equipment

2. Demonstrate How to Prepare Film Processing Chemicals

Activities:

- a. Read page 15 in Basic Photography for the Graphic Arts.
- b. Read pages 211 to 212 in Photo Offset Fundamentals.
- c. Watch a demonstration on film processing chemicals and how to prepare them for use.
- d. On the worksheet, identify the film processing chemicals.
- e. Practice preparing the chemicals for film processing.

Materials:

Film processing chemicals, graduate

3. Perform the Steps in Processing a Line Negative

Activities:

- a. Read pages 16 to 17 in Basic Photography for the Graphic Arts.

- b. Read pages 212 to 215 in Photo Offset Fundamentals.
- c. Watch a demonstration on how to process a line negative.
- d. Outline the steps in processing a line negative.
- e. Practice developing scrap line film.

Materials:

Developer, stop bath, fixer, scrap line film, trays, timer

EVALUATION:

1. Using an exposed sheet of film either from Lesson 2 or provided by the instructor, develop the line negative to provide black background and fine lines in the image area.

Submit the completed line negative to your instructor for evaluation.

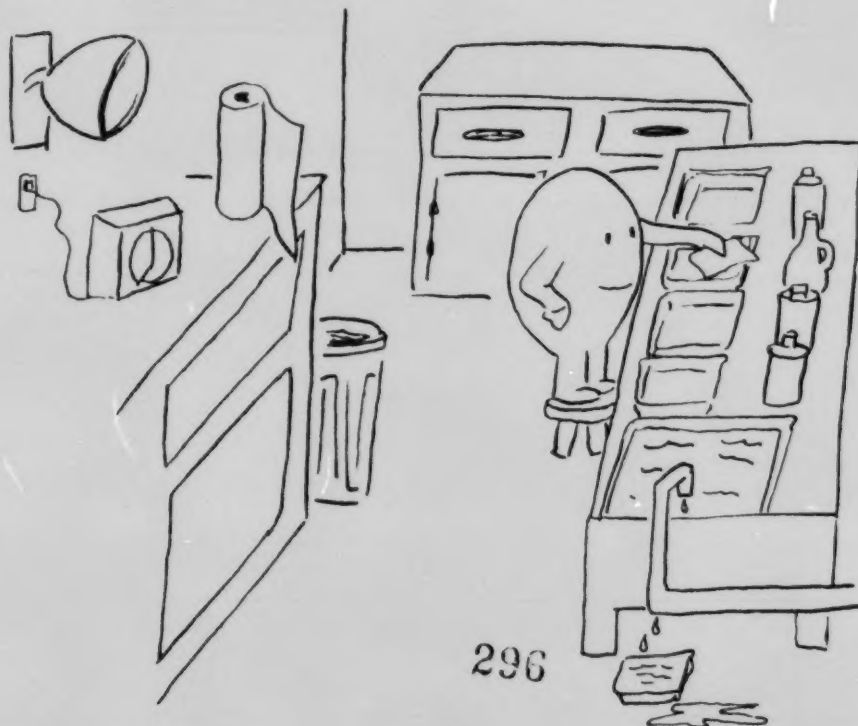
2. Complete the worksheet and submit it to your instructor for evaluation.

3. Complete the attitude sheet.

RESOURCES:

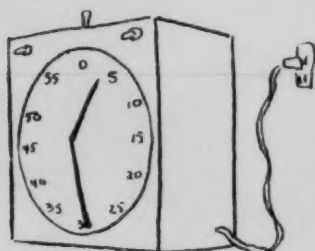
Basic Photography for the Graphic Arts. Rochester, New York, Eastman Kodak Co., 1972.

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.

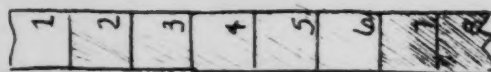


WORKSHEET

1. Identify the following equipment:



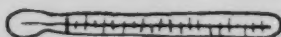
a. _____



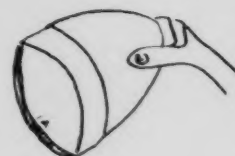
b. _____



d. _____



c. _____



e. _____

2. Name the three chemicals used in processing graphic arts film.

3. TRUE or FALSE. A yellow safelight is used while processing graphic arts film.

4. TRUE or FALSE. The developer will clear all of the milky look in graphic arts film.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Develop a Line Negative					
Preparing the Developing Chemicals					
Developing a Line Negative					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Enlarge Line Copy

LEARNING OBJECTIVES:

1. Outline the Steps in Adjusting the Process Camera to Enlarge Line Copy

Activities:

- a. Watch a demonstration on setting bellows and copy controls to enlarge line copy.
- b. Practice setting bellows and copy controls.
- c. Practice checking size and focus on ground glass focusing screen.

Materials:

Process camera

2. Discuss How Exposure Times Change with Enlargement

Activities:

- a. Read page 14 in Basic Photography for the Graphic Arts.
- b. Read page 137 in Photo Offset Fundamentals.
- c. Watch a demonstration on how to find new exposure times for enlargement (or reduction).
- d. Practice using Exposure Time Factor Table to find new exposure times.
- e. Practice setting the timer on the process camera for new times.

Materials:

Process camera

EVALUATION:

1. Using line copy provided by your instructor, enlarge it to 150% and produce a line negative.

Submit the completed negative to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Basic Photography for the Graphic Arts. Rochester, New York,
Eastman Kodak Co., 1972.

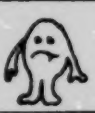
Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois,
McKnight Publishing Co., 1973.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ART'S PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Adjusting the Process Camera to Enlarge Copy					
Changing Exposure Times for Enlargement					
Enlarging Copy					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Reduce Line Copy

LEARNING OBJECTIVES:

1. Outline the Steps in Adjusting the Process Camera to Reduce Line Copy

Activities:

- a. Watch a demonstration on setting bellows and copy controls to reduce line copy.
- b. Practice setting bellows and copy controls for reduction.
- c. Practice using the Exposure Time Factor Table to find new times for reduction.

Materials:

Process camera

2. Use the Proportion Scale

Activities:

- a. Read pages 111 to 113 in Photo-Offset Fundamentals.
- b. Watch a demonstration on scaling enlargements and reductions with the Proportion Scale.
- c. Use the Proportion Scale to determine the amount of enlargement or reduction for copy.

Materials:

Copy, Proportion Scale

EVALUATION:

1. Using the same copy as in Lesson 4, reduce it to 75% and produce a line negative. Submit the completed negative to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

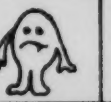
Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Adjusting the Process Camera to Reduce Copy					
Using the Proportion Scale					
Reducing Copy					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Produce a Halftone Negative

LEARNING OBJECTIVES:

1. Explain How Halftone Dots Produce Pictures

Activities:

- a. Read pages 144 to 148 in Photo Offset Fundamentals.
- b. Watch a demonstration on how halftone dots produce a picture.
- c. Explain why pictures must be printed as halftones.
- d. Look at a picture printed in your book and observe the halftone dots.
- e. Watch the slide/tape show: Halftones and Other Tones.

Materials:

Book, magnifying glass

2. Discuss the Tools and Equipment Used in Halftone Photography

Activities:

- a. Read pages 149 to 150 and pages 154 to 164 in Photo Offset Fundamentals.
- b. Watch a demonstration on the tools and equipment used in halftone photography.
- c. From an assortment of photographic equipment and tools, identify each item and its use.
- d. Tell what equipment is used in halftone photography which is not used in line photography.

Materials:

Assortment of photographic equipment

3. Perform the Steps in Making a Halftone Negative

Activities:

- a. Read pages 20 to 23 in Basic Photography for the Graphic Arts.
- b. Read pages 158 to 165 in Photo Offset Fundamentals.
- c. Watch a demonstration on how to make a halftone negative.
- d. Tell why some halftone screens have larger dot patterns than others.
- e. Explain the purpose of the flash exposure.
- f. Practice exposing a halftone negative from continuous tone copy.

Materials:

Photograph, process camera, halftone screen, point light source, film, chemicals

EVALUATION:

1. Using a photograph provided by the instructor, reproduce it at 100% and prepare a halftone negative having a 10% shadow dot and a 90% highlight dot.

Submit the completed halftone negative to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Basic Photography for the Graphic Arts. Rochester, New York, Eastman Kodak Co., 1972.

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How Printed Pictures are Made From Halftone Dots					
Learning What Tools and Equipment are Needed to Make Halftones					
Making Halftone Negatives					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Make a Contact Film Positive

LEARNING OBJECTIVES:

1. Discuss the Need for a Contact Film Positive

Activities:

- a. Watch a demonstration on the use of a contact film positive.
- b. List several uses for a film positive.
- c. Look at a line negative and a contact positive and observe their difference.

Materials:

Line negative, contact positive

2. Perform the Steps for Making a Contact Film Positive

Activities:

- a. Read pages 26 to 27 in Basic Photography for the Graphic Arts.
- b. Watch a demonstration on how to make a contact film positive.
- c. Outline the steps for making a contact film positive.
- d. Practice making a contact film positive on scrap film.

Materials:

Scrap film, line negative, contact printer, chemicals, timer

EVALUATION:

1. Using the line negative produced in Lesson 2, expose and process a contact film positive.

Submit the completed positive to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Basic Photography for the Graphic Arts. Rochester, New York,
Eastman Kodak Co., 1972.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding-Out the Need for a Contact Film Positive					
Making a Contact Film Positive					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Make a Duplicate Negative

LEARNING OBJECTIVES:

1. Discuss the Film Used for Duplicating Negatives

Activities:

- a. Read page 28 in Basic Photography for the Graphic Arts.
- b. Watch a demonstration on the uses for a duplicate negative.
- c. Watch a demonstration on the film used in making a duplicate negative.
- d. Name the film used in making a duplicate negative.

Materials:

None

2. Perform the Steps in Preparing a Duplicate Negative

Activities:

- a. Read page 28 in Basic Photography for the Graphic Arts.
- b. Watch a demonstration on how to make a duplicate negative.
- c. Outline the steps in making a duplicate negative.
- d. Practice making a duplicate negative on scrap duping film.

Materials:

Scrap duping film, line negative, contact printer, chemicals, timer

EVALUATION:

1. Using the line negative produced in Lesson 4, expose and develop a duplicate negative.

Submit the finished duplicate negative and the original to the instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Basic Photography for the Graphic Arts. Rochester, New York,
Eastman Kodak Co., 1972.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How to Make a Duplicate Negative					
Making a Duplicate Negative					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Photograph Colored Line Copy

LEARNING OBJECTIVES:

1. Discuss the Need for Using Colored Filters in Producing Some Line Negatives

Activities:

- a. Read pages 141 to 142 in Photo Offset Fundamentals.
- b. Watch a demonstration on the need to photograph colored copy.
- c. List some copy which might need to be filtered to produce a line negative.

Materials:

None

2. Suggest Filters and Film to Hold or Drop a Color

Activities:

- a. Read Table 3 on page 142 in Photo Offset Fundamentals.
- b. Watch a demonstration on film and filters used in holding or dropping a color.
- c. Practice using a Film and Filter Combination Table to see how to hold or drop a color.

Materials:

Film and Filter Combination Table

3. Perform the Steps in Photographing Colored Line Copy

Activities:

- a. Watch a demonstration on how to photograph colored copy on line film.
- b. Outline the steps in photographing colored copy.
- c. Practice photographing colored copy on scrap line film.

Materials:

Colored copy, filters, Film and Filter Combination Table,
line film, process camera, chemicals, timer

EVALUATION:

1. Using colored copy provided by the teacher, select the appropriate film, filter and exposure to make one high contrast line negative holding the color and another negative dropping the color. After you have made your selections, expose and develop the two negatives.

Submit the completed line negative to your instructor for evaluation on how well you held or dropped the color.

2. Complete the attitude sheet.

RESOURCES:

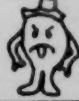
Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois,
McKnight Publishing Co., 1973.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT GRAPHIC ARTS PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Photograph Colored Copy					
Suggesting Filters to Photograph Colored Copy					
Photographing Colored Copy					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Graphic Arts Photographer

OCCUPATIONAL COMPETENCY: Layout and Strip a Flat

LEARNING OBJECTIVES:

1. Explain the Function of a Flat

Activities:

- a. Read page 233 in Photo Offset Fundamentals.
- b. Watch a demonstration on the function of a flat.
- c. Explain what a flat is used for.

Materials:

None

2. Describe the Materials Used in Laying Out and Stripping a Flat

Activities:

- a. Read page 236 in Photo Offset Fundamentals.
- b. Watch a demonstration on the materials used in laying out and stripping a flat.
- c. List the materials and equipment needed to strip a flat.
- d. Look at a sheet of goldenrod paper and identify all positioning marks.

Materials:

Goldenrod paper

3. Perform the Procedure in Laying Out and Stripping a Flat

Activities:

- a. Read pages 237 to 243 in Photo Offset Fundamentals.
- b. Watch a demonstration on laying out and stripping the flat.

- c. Look at a finished flat and observe its arrangement.
- d. Practice laying out and stripping a flat.
- e. Practice applying opaque to your practice flat.

Materials:

None

EVALUATION:

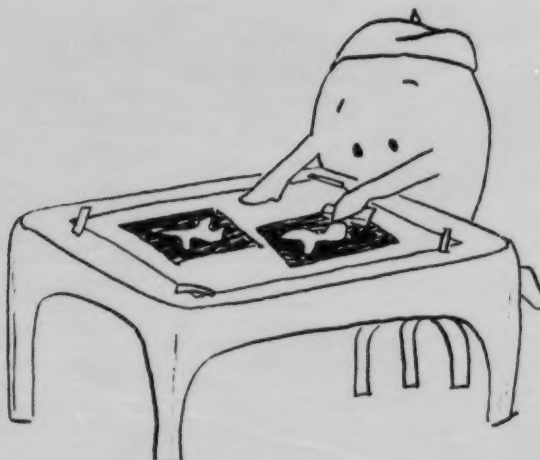
1. Using negatives from previous lessons or provided by the instructor, lay out the flat to allow printing on an $8\frac{1}{2}$ x 11 sheet and strip-in the negatives. Some attention should be paid to the orderly arrangement of the negatives. Opaque all necessary areas.

Submit the finished flat to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Cogoli, John E. Photo Offset Fundamentals. Bloomington, Illinois, McKnight Publishing Co., 1973.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT GRAPHIC ARTS PHOTOGRAPHY

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Flat Is					
Seeing How to Prepare a Flat					
Stripping a Flat					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

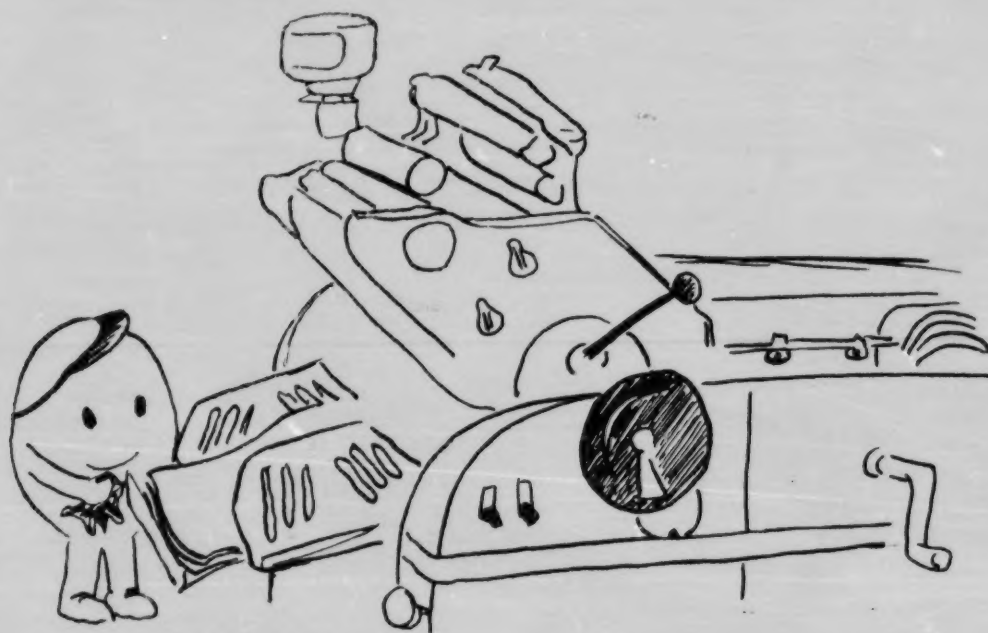
UNIT OF STUDY: Printer

DOT OCCUPATIONAL CATEGORY: Machine Trades

DOT OCCUPATIONAL DIVISION: Printing

DOT OCCUPATIONAL GROUP: Printing Press Occupations

OCCUPATIONAL OVERVIEW: The printer sets up and operates printing presses, plate-making equipment, paper cutters, drills and folding machines to print and produce items such as decorative wrappers, advertisements, office forms, menus, books, etc. May operate letterpress, gravure press or offset lithographic press. May operate small, single color duplicator or large multicolor, web fed printing press.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

651.380-010	Printer
651.362-030	Web-Press Operator
651.362-018	Platen Press Operator
651.382-038	Transfer Operator
651.482-010	Offset-Press Operator
207.682-018	Offset-Duplicating-Machine Operator

LESSON 1

UNIT: Printer

OCCUPATIONAL COMPETENCY: Lock-Up Hot Type

LEARNING OBJECTIVES:

1. Identify the Materials Used in Locking-Up Hot Type for the Platen Press

Activities:

- a. Read pages 42 to 45 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on materials for locking-up hot type.
- c. From an assortment of lock-up materials, identify each item and explain its use.
- d. On the worksheet, identify lock-up material.

Materials:

Assortment of lock-up material

2. Lock-Up the Type Form

Activities:

- a. Read pages 42 to 45 in Graphic Arts/Swerdlow.
- b. Watch a demonstration showing how to lock-up a type form.
- c. Identify a chaser lock-up method.
- d. Practice locking-up a type form with the method shown in the demonstration.

Materials:

Type form, chase, furniture, quoins, quoin key, reglets

3. Plane and Test for Lift

Activities:

- a. Read page 44 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on planing a type form and testing for lift.
- c. On the worksheet, tell how to plane a type form and check for lift.
- d. Practice planing a lock-up type form and checking for lift.

Materials:

Locked-up type form, plane, quoin key

EVALUATION:

1. Using a type form prepared in the unit "Graphic Arts Compositor" or using one assembled for this purpose, lock-up a form. Do this in a chase for a hand operated platen press using the chaser lock-up method. Plane the form and test for lift.

Show the locked-up form to your teacher for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

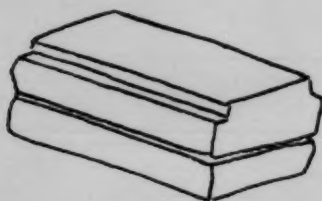
RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

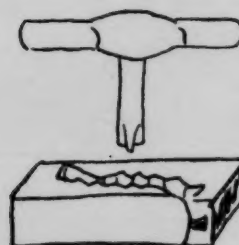


WORKSHEET

1. Identify these tools:

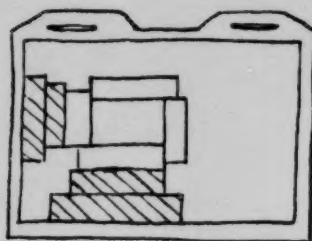


a. _____



b. _____

2. In the following illustration, what lock-up method is shown?



3. Describe how to plane a type form and check for lift.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Materials for Locking-Up Type					
Learning How to Lock-Up Type					
Locking-Up a Type Form					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Printer

OCCUPATIONAL COMPETENCY: Discuss the Set-Up and Operation of the Platen Press

LEARNING OBJECTIVES:

1. Describe How a Platen Press Works

Activities:

- a. Read pages 46 to 47 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how a platen press works and what it does.
- c. On the worksheet, identify the three types of letter-presses.

Materials:

None

2. Name the Parts of a Power-Operated Platen Press

Activities:

- a. Read page 47 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the parts of the power-operated platen press.
- c. Look at a platen press and name the major parts.
- d. On the worksheet, identify the parts of the platen press.

Materials:

Platen Press

3. Perform the Steps for Setting-Up a Platen Press for Printing

Activities:

- a. Read pages 48 to 52 in Graphic Arts/Swerdlow.

- b. Watch a demonstration outlining the steps for setting-up a platen press for printing.
- c. On the worksheet, list the steps in setting-up a platen press for printing.
- d. Practice setting-up a platen press for printing.
- e. Watch the movie: Printing - Platen Press Makeready.

Materials:

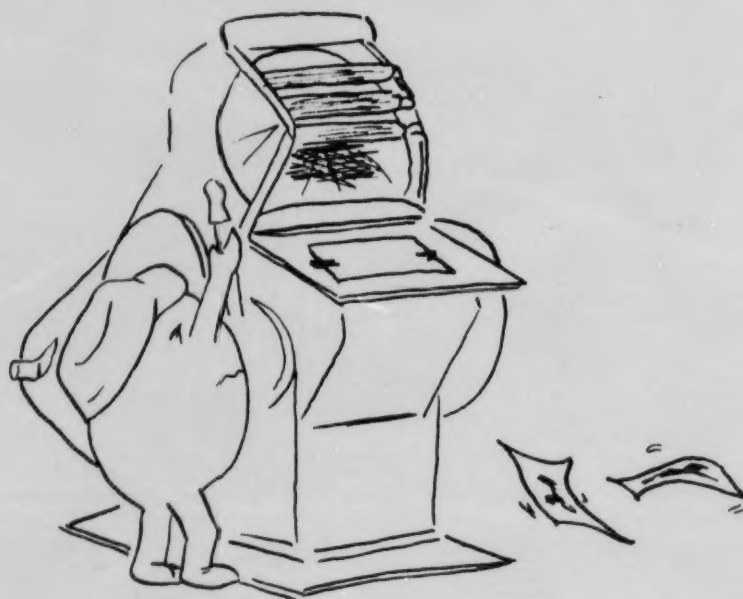
Platen press, locked-up type form, ink, spatula, tympan sheet, pressboard, gauge pins, quoin key, paper

EVALUATION:

- 1. The instructor will evaluate your set-up for both a hand-operated platen press (pilot) and a power-operated platen press in future lessons.
- 2. Complete the worksheet and submit it to your instructor for evaluation.
- 3. Complete the attitude sheet.

RESOURCES:

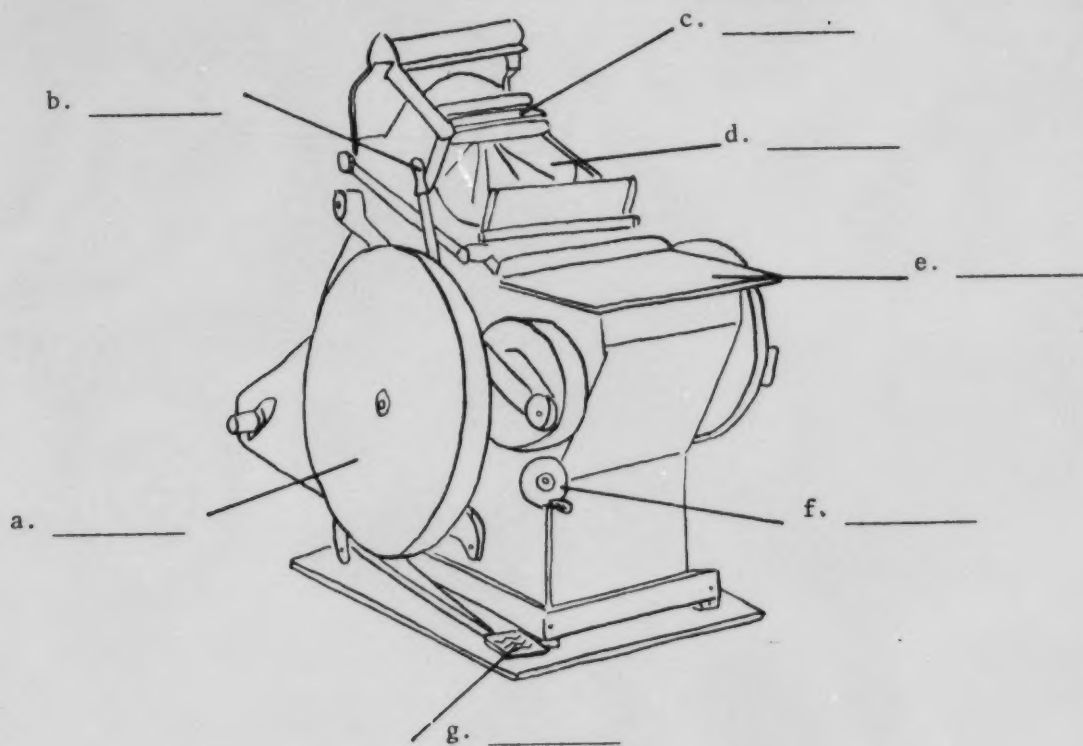
Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the three types of letterpress.

2. Name the parts of the following platen press:



3. List the steps (in order) for setting-up a platen press for printing.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How a Platen Press Works					
Finding-Out the Parts of the Platen Press					
Seeing How to Set-Up the Press to Print					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Printer

OCCUPATIONAL COMPETENCY: Print With a Pilot Press

LEARNING OBJECTIVES:

1. Outline the Operation of the Pilot Press

Activities:

- a. Watch a demonstration on how a pilot press operates.
- b. Review Lesson 2 on how to set-up a platen press to print.
- c. On the worksheet, compare the set-up and operation of the pilot press with that of the platen press.
- d. On the worksheet, name the parts of the pilot press.

Materials:

None

2. Print With the Pilot Press

Activities:

- a. Watch a demonstration on how to print with the pilot press.
- b. Practice operating the pilot press.

Materials:

Pilot press, type form, ink, paper, chase, furniture, quoins, quoin key, reglets, plane, spatula, tympan sheet, pressboard, gauge pins

EVALUATION:

1. On the pilot press:

- A. Set-up the press for printing. Have your instructor check the prepared pilot press to make sure it has been done correctly.

B. Using the locked-up form from Lesson 1, or using one prepared for this purpose, place the type form in the press.

C. Print 20 copies.

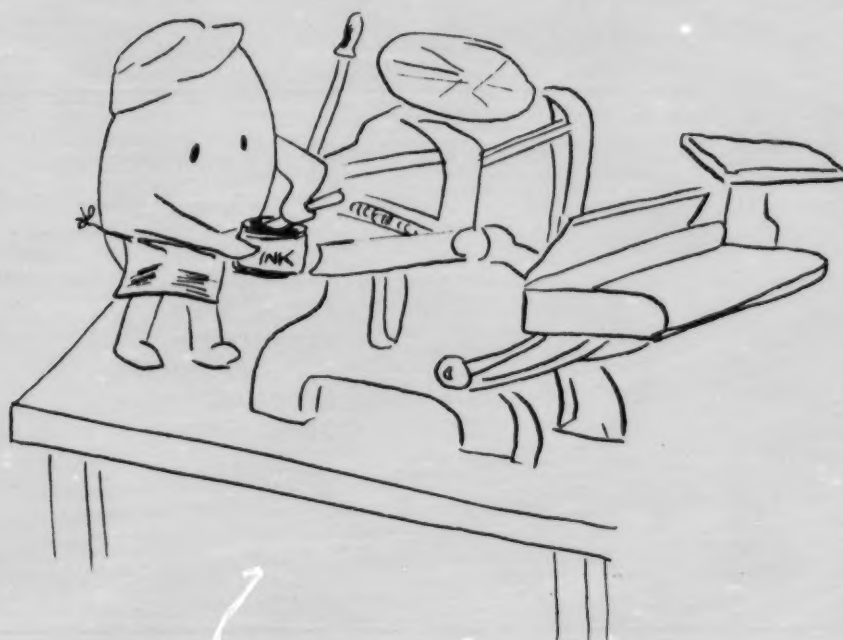
Submit one copy of the prints made on the pilot press to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.

3. Complete the attitude sheet.

RESOURCES:

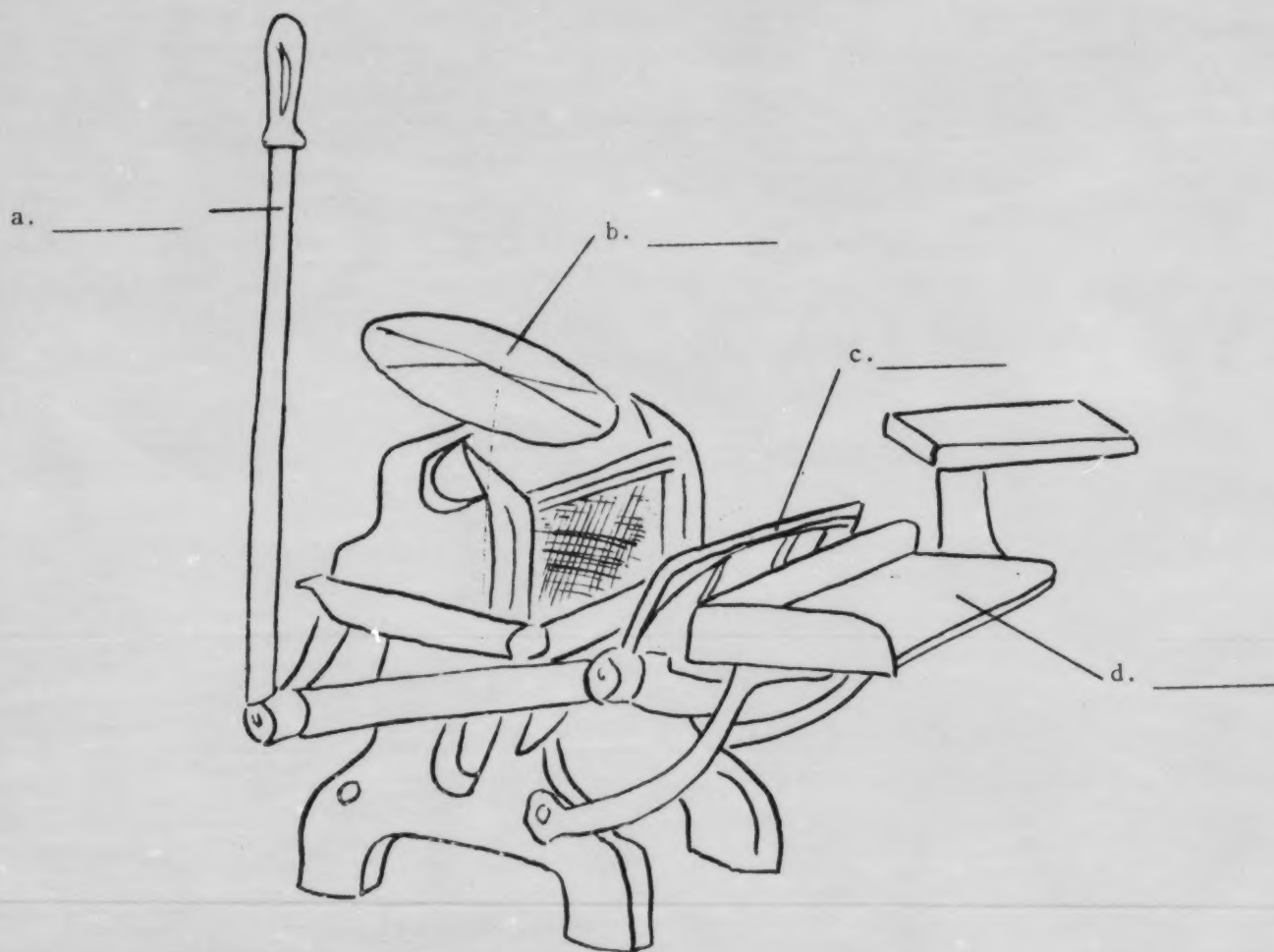
Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Compare the set-up and operation of the pilot press with that of the platen press.

2. Name the parts of the following pilot press:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How to Operate a Pilot Press					
Setting-Up a Pilot Press					
Printing with a Pilot Press					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Printer

OCCUPATIONAL COMPETENCY: Print With a Power-Operated Platen Press

LEARNING OBJECTIVES:

1. Print With the Power-Operated Platen Press

Activities:

- a. Read pages 51 to 52 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to print with the power-operated platen press.
- c. Review the activities in Lesson 3.
- d. Practice operating the platen press.

Materials:

Platen press, locked-up type form, set-up materials

EVALUATION:

1. On the power-operated platen press:

- A. Set-up the press for printing. Have your instructor check the prepared platen press to make sure it has been done correctly.
- B. Using the locked-up form from Lesson 1, or using one prepared for this purpose, place the type form in the press.
- C. Print 20 copies.

Submit one copy of the prints made on the power-operated platen press to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

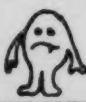
NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing how to Operate a Power Operated Platen Press					
Setting-Up a Power-Operated Platen Press					
Printing with a Power-Operated Platen Press					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Printer

OCCUPATIONAL COMPETENCY: Make a Rubber Stamp

LEARNING OBJECTIVES:

1. Identify the Four Main Steps in Making a Rubber Stamp

Activities:

- a. Read page 55 in Graphic Arts/Swerdlow.
- b. Watch a demonstration introducing rubber stamp making.
- c. On the worksheet, identify the four main steps in rubber stamp making.
- d. On the worksheet, compare chase lock-up for rubber stamp making with chase lock-up for platen press printing.

Materials:

None

2. Outline the Preparation of the Matrix and Rubber Stamp

Activities:

- a. Read pages 56 to 57 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to prepare the matrix of a rubber stamp.
- c. Watch a demonstration on how to prepare the rubber of a rubber stamp.
- d. On the worksheet, outline the preparation of the matrix and rubber stamp.
- e. Look at the stamp making materials and identify the role of each.
- f. Practice making a matrix and rubber with scrap material.

Materials:

Rubber stamp press, chase, tray, metal furniture, quoins, quoin key, matrix board, paper, screwdriver, stamp rubber, wood handle

3. Tell How to Mount the Stamp on a Handle

Activities:

- a. Read page 57 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on mounting the stamp on a handle.
- c. Practice mounting stamp rubber on a wood handle with scrap material.

Materials:

Stamp rubber, wood handle, rubber cement

EVALUATION:

1. Make a rubber stamp of your own choosing and print 10 copies. Submit one copy of these prints to your instructor for evaluation.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the four main steps in rubber stamp making.
2. Compare chase lock-up for rubber stamp making with chase lock-up for platen press printing.
3. Out line the preparation of the matrix and the rubber stamp.
4. TRUE or FALSE. The rubber stamp must be wrong reading for it to print correctly.
5. MULTIPLE CHOICE. To prevent the stamp rubber from sticking to the matrix, always (a) dust the rubber with soapstone (b) heat the press to 500°F (c) use wooden type to make the matrix (d) cover the matrix with heavy plastic.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Steps in Making a Rubber Stamp					
Making a Rubber Stamp					
Printing with a Rubber Stamp					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Printer

OCCUPATIONAL COMPETENCY: Prepare a Direct-Image Plate

LEARNING OBJECTIVES:

1. Explain How a Lithographic Plate Works

Activities:

- a. Read page 74 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how a lithographic plate works.
- c. On the worksheet, explain how a lithographic plate works.

Materials:

None

2. Identify the Three Types of Lithographic Plates

Activities:

- a. Read page 74 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the three types of lithographic plates.
- c. On the worksheet, list the three types of lithographic plates.

Materials:

None

3. Prepare a Direct-Image Plate

Activities:

- a. Read page 74 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how to prepare a direct-image plate.

- c. On the worksheet, sketch a direct-image plate and identify the guidelines.
- d. Practice making a direct-image plate using scrap material. Use a typewriter and a grease pencil.

Materials:

Scrap direct-image plate material, typewriter, grease pencil, fountain solution

EVALUATION:

1. Using both a typewriter with a film ribbon and a grease pencil, prepare a direct-image plate of your favorite cartoon character. This plate will be used in Lesson 9.

Submit the plate to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Tell How a lithographic plate works.
2. List the three types of lithographic plates.
3. Sketch a direct image plate and identify the guidelines.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How a Lithographic Plate Works					
Preparing a Direct-Image Plate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Printer

OCCUPATIONAL COMPETENCY: Prepare a Presensitized Plate

LEARNING OBJECTIVES:

1. Describe the Operation of a Platemaker

Activities:

- a. Read page 85 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on how a platemaker operates.
- c. Practice operating a platemaker.
- d. Tell the major safety precaution in using the platemaker.

Materials:

Platemaker

2. Prepare a Presensitized Plate

Activities:

- a. Read page 78 and pages 85 to 86 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on preparing a presensitized plate.
- c. On the worksheet, outline how to expose and process a presensitized plate.
- d. Practice preparing a presensitized plate using scrap plate material.

Materials:

Scrap plate material, negative, platemaker, plate desensitizer, lacquer, gum arabic, cotton pad

EVALUATION:

1. Using a flat prepared in the unit "Graphic Arts Compositor", or using one prepared for this purpose, expose and process a presensitized plate. This plate will be used in Lesson 9.

Submit the plate to your instructor for evaluation.

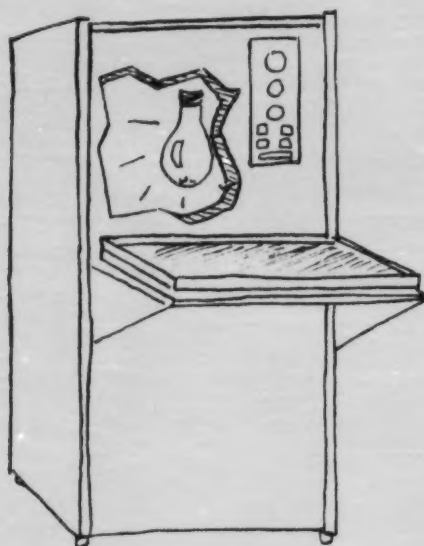
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Identify the following piece of equipment:



2. Outline the steps in the preparation of a presensitized plate.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Discovering How the Platemaker Works					
Preparing a Pre-Sensitized Plate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Printer

OCCUPATIONAL COMPETENCY: Discuss the Offset Press

LEARNING OBJECTIVES:

1. Identify the Six Main Systems of the Offset Lithographic Press

Activities:

- a. Read page 87 in Graphic Arts/Swerdlow.
- b. Watch a demonstration identifying the six main systems of the offset lithographic press.
- c. Look at an offset press and identify the six main systems.
- d. On the worksheet, identify the six main systems of the offset lithographic press.
- e. Watch the movie: Lithography Or Offset Printing

Materials:

Offset lithographic press

2. Tell How the Image Area of the Plate Is Inked

Activities:

- a. Read pages 88-89 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the inking system of the offset lithographic press.
- c. Look at the inking system of the offset lithographic press and identify its parts and operation.

Materials:

Offset lithographic press

3. Tell How the Non-Image Area Is Coated With Water

Activities:

- a. Read page 88 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the dampening system of the offset lithographic press.
- c. Look at the dampening system of the offset lithographic press and identify its parts and operation.

Materials:

Offset lithographic press

4. Describe How the Paper Is Fed Through the Machine

Activities:

- a. Read pages 89 and 91 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the feeding, registering and delivery systems of the offset lithographic press.
- c. Look at the feeding system of the offset lithographic press and identify its parts and operation.
- d. Look at the registering system of the offset lithographic press and identify its parts and operation.
- e. Look at the delivery system of the offset lithographic press and identify its parts and operation.

Materials:

Offset lithographic press

5. Discuss How Printing Takes Place on the Offset Lithographic Press

Activities:

- a. Read pages 66 to 67 and page 90 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on the printing system of an offset lithographic press.
- c. Look at the printing system of an offset lithographic press and identify its parts and operation.

Materials:

Offset lithographic press

EVALUATION:

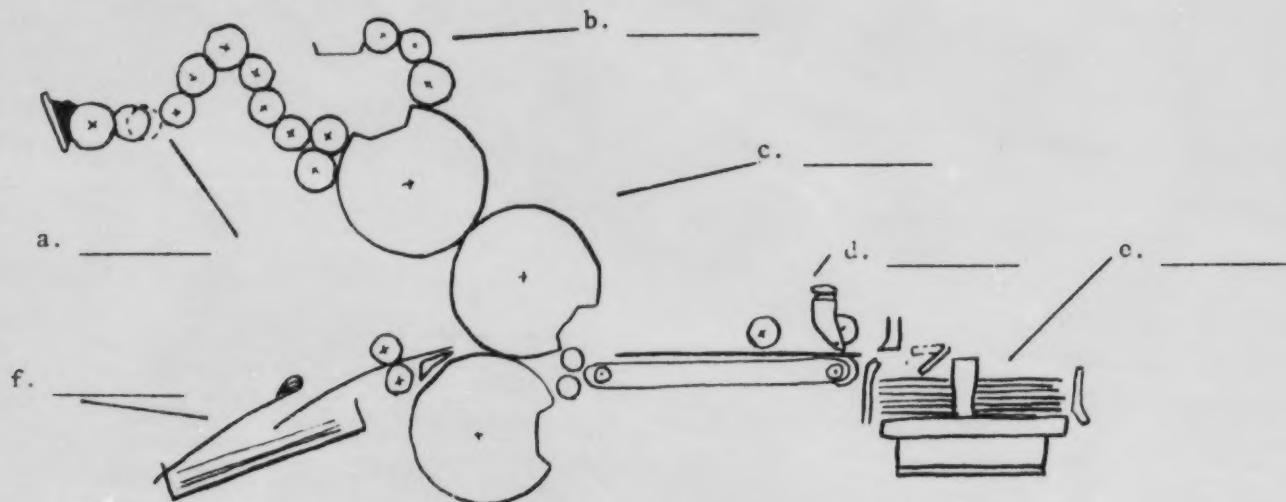
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Identify the six main systems on the following sketch of an offset lithographic press.



2. Prepare simple diagrams to show "friction" and "air and vacuum" feeding techniques used on offset lithographic presses.

3. TRUE or FALSE. Lithographic ink should be greasy and must not dissolve in fountain solution.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Systems of an Offset Press					
Seeing How Paper is Fed Through an Offset Press					
Seeing How Printing Takes Place on an Offset Press					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Printer

OCCUPATIONAL COMPETENCY: Print With an Offset Lithographic Plate

LEARNING OBJECTIVES:

1. Print With the Offset Lithographic Press

Activities:

- a. Watch a demonstration on how to operate the shop offset press.
- b. Look at the offset lithographic press and identify all controls and their use.
- c. Practice attaching a plate to the press and running it.

Materials:

Offset lithographic press, prepared plate, paper

EVALUATION:

1. On the offset lithographic press:

- A. Attach the direct-image plate made in Lesson 6 and prepare it to print. Make 20 copies. Submit one copy of these prints to your instructor for evaluation.
- B. Attach the pre-sensitized plate made in Lesson 7 and prepare it to print. Make 20 copies. Submit one copy of these prints to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

None

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How the Offset Press Works					
Operating the Offset Press					
Printing From a Direct-Image Plate					
Printing From a Pre-Sensitized Plate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Printer

OCCUPATIONAL COMPETENCY: Discuss Paper and Paper Making

LEARNING OBJECTIVES:

1. Tell About Paper

Activities:

- a. Read pages 58 to 59 in Graphic Arts/Kagy.
- b. Read pages 114 to 115 in Graphic Arts/Swerdlow.
- c. Watch a demonstration on the different kinds, sizes and weights of paper.
- d. On the worksheet, identify the uses for some different kinds of paper.
- e. From an assortment of different kinds of paper, identify each kind and tell its use.

Materials:

Assortment of paper

2. Tell How Paper Is Made Commercially

Activities:

- a. Read pages 113 to 115 in Graphic Arts/Swerdlow.
- b. Watch a demonstration on commercial paper making.
- c. Watch the movie: Paper Making.

Materials:

None

3. Make a Sheet of Paper by Hand

Activities:

- a. Read pages 112 to 113 in Graphic Arts/Swerdlow.

- b. Watch a demonstration on making paper by hand.
- c. Practice making paper by hand.

Materials:

Pail, mold, deckle, egg beater, rolling pin, electric iron, blotting paper, starch, tissue paper

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to the instructor for evaluation.
2. Make a sheet of paper by hand. After it is dry, cut it to size and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Kagy, Frederick D. Graphic Arts. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1970.

Swerdlow, Robert M. Graphic Arts. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Tell the uses of the following kinds of paper:

Bond:

Duplicator:

Mimeo:

Bristol:

Newsprint:

2. Tell what a fourdrinier machine is.

3. Define ream.

4. Describe how paper is made by hand.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT PRINTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Types of Paper					
Seeing How Paper is Made					
Making a Sheet of Paper					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Commercial Photographer

DOT OCCUPATIONAL CATEGORY: Professional, Technical and Managerial

DOT OCCUPATIONAL DIVISION: Art

DOT OCCUPATIONAL GROUP: Photography

OCCUPATIONAL OVERVIEW: The commercial photographer photographs subjects using still or motion picture cameras in color or black and white. Selects and assembles equipment according to assignment. Analyzes subject, setting and plan and arranges elements to produce desired overall effect. Adjusts camera, exposes film and develops prints. May specialize in a particular field such as fashion, architecture or portraits.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

143.062-030	Photographer, Still
143.062-022	Photographer, Motion Picture
143.062-010	Director of Photography
143.062-014	Photographer, Aerial
143.062-034	Photojournalist
143.362-010	Biological Photographer
976.687-018	Photofinishing Laboratory Worker

LESSON 1

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Discuss Cameras and Their Operation

LEARNING OBJECTIVES:

1. Describe How a Pin-Hole Camera Works

Activities:

- a. Read pages 13 to 15 in Photography.
- b. Watch a demonstration on how a pin-hole camera works.
- c. Make a simple pin-hole camera.
- d. On the worksheet, tell how a pin-hole camera works.
- e. Watch the movie: Pin-Hole Camera.

Materials:

Coffee can, aluminum foil, black paint, nail, needle, tape, black paper

2. Name and Discuss Six Types of Cameras

Activities:

- a. Read pages 29 to 33 in Photography.
- b. Watch a demonstration on the various types of cameras.
- c. From an assortment of cameras, identify each type and tell what it is used for.
- d. On the worksheet, identify some camera types.
- e. Name the three adjustments that some complex cameras have.
- f. Watch the movie: Camera.

Materials:

Assortment of cameras

3. Explain How Light Exposure Is Controlled in Modern Cameras

Activities:

- a. Read pages 34 to 38 in Photography.
- b. Watch a demonstration on how light exposure is controlled in a camera.
- c. Tell what the shutter and aperture do in a camera.
- d. On the worksheet, name the usual shutter speeds and aperture settings on a camera.
- e. Define "f-stop".
- f. Watch the movie: Photography - Anatomy of Camera and Film.

Materials:

None

EVALUATION:

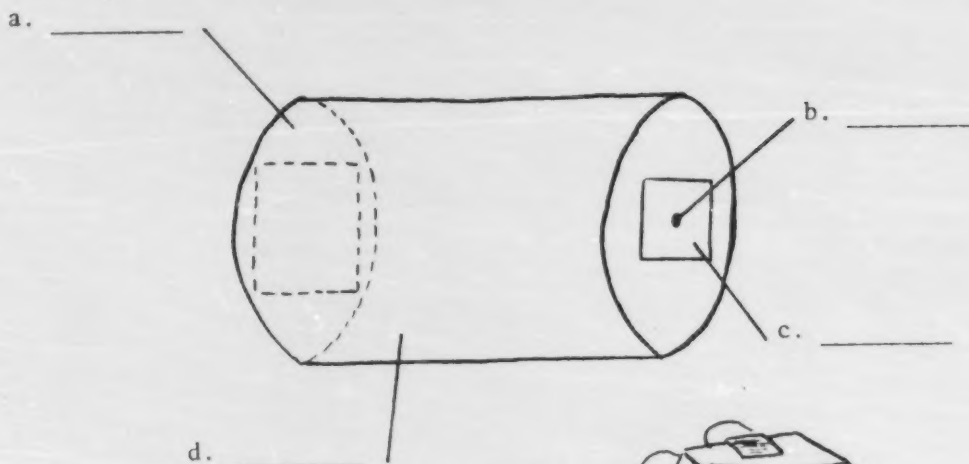
1. Complete the worksheet. Submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

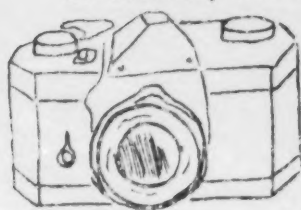
Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

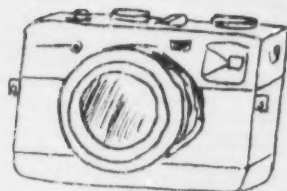
1. Name the parts of the pin-hole camera.



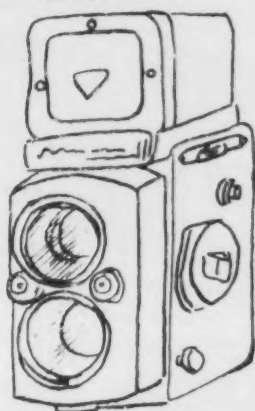
2. Identify the following types of cameras:



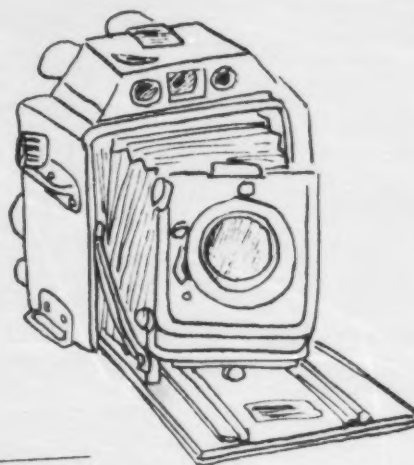
a. _____



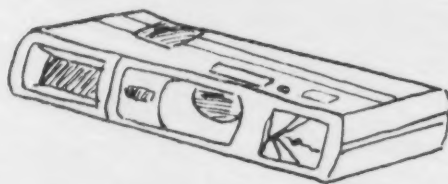
d. _____



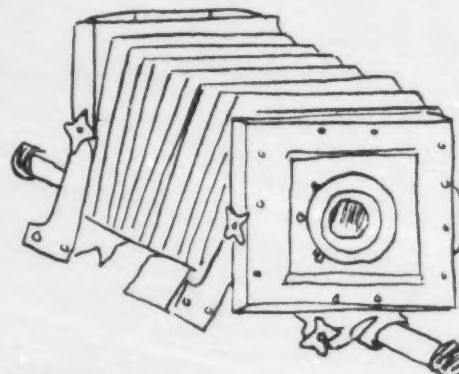
b. _____



c. _____



e. _____



f. _____

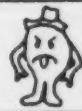
3. List the shutter speeds and aperture settings on the average camera.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out How a Camera Works					
Seeing the Different Types of Cameras					
Learning How to Adjust a Camera					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Describe Basic Concepts in Photography

LEARNING OBJECTIVES:

1. Name the Types of Film and Their Characteristics

Activities:

- a. Watch a demonstration on the different types of film and their use.
- b. Define "ASA".
- c. Tell what film to use for different picture taking situations.
- d. Tell what size film fits your camera.
- e. Watch the slide/tape show: Film - How It Works.
- f. Watch the movie: Light Sensitive Materials.

Materials:

None

2. Use an Exposure Meter

Activities:

- a. Read pages 52 to 53 in Photography.
- b. Watch a demonstration on how to use an exposure meter.
- c. On the worksheet, identify the parts of the exposure meter.
- d. Tell how to use an exposure meter.
- e. Practice using an exposure meter by setting the ASA and reading the levels of light in your room.
- f. Watch the movie: Exposure Meter - Theory and Use.

Materials:

Exposure meter

3. Discuss Photographic Composition

Activities:

- a. Read pages 42 to 45 in Photography.
- b. Watch a demonstration on how to compose a photograph.
- c. Look at an assortment of photographs and discuss the composition of each.
- d. On the worksheet, tell three things to consider when composing a photograph.
- e. Watch the movie: Composition for Photography.

Materials:

Assortment of photographs

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

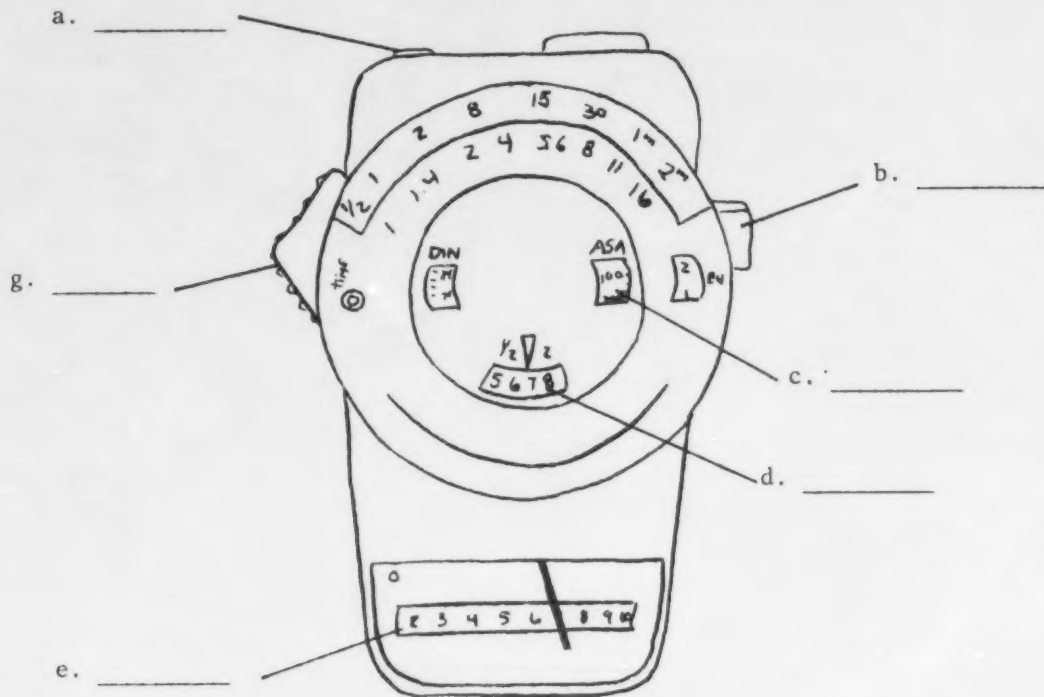
RESOURCES:

Lathrop, Irvin and LaCour Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the parts of the following exposure meter:



2. Look at the above exposure meter and answer the following questions:

a. What ASA value has been set? _____

b. What aperture should be used if the shutter speed is 1/30 sec?

c. Was this exposure reading taken indoors or outdoors? _____

3. Tell three things to consider when composing a photograph.

STUDENT ATTITUDE SHEET

for

CLUSTER

MANUFACTURING

UNIT

COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Film					
Using an Exposure Meter					
Seeing How to Compose a Photograph					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Expose a Roll of Black and White Film

LEARNING OBJECTIVES:

1. Explain How to Properly Handle a Camera

Activities:

- a. Read pages 39 to 41 in Photography.
- b. Watch a demonstration on how to properly handle a camera.
- c. Show how to properly handle a camera.
- d. Tell why you should use a tripod when selecting a slow shutter speed.
- e. Watch the slide/tape show: Basic Picture Taking Techniques.

Materials:

Camera

2. Adjust Shutter Speeds and Aperture Settings

Activities:

- a. Watch a demonstration on how to adjust shutter speeds and aperture settings.
- b. Tell what shutter speed or aperture setting to use for a variety of picture taking situations.
- c. Explain how to control "depth of field".
- d. Define the rule "one f/stop is equal to one shutter speed".

Materials:

None

EVALUATION:

1. Using black and white film, take some pictures around your school or home. Give some thought to good subjects, composition and camera handling. Remove the film from your camera, and have it ready to develop in Lesson 4.
2. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for _____

CLUSTER MANUFACTURINGUNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Handle a Camera					
Taking Pictures					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Develop Black and White Film

LEARNING OBJECTIVES:

1. List the Chemicals Used in Developing Black and White Film

Activities:

- a. Read pages 46 to 51 in Photography.
- b. Watch a demonstration on the chemicals used in developing film.
- c. Name the chemicals used in developing film.
- d. Prepare the chemicals for use in developing black and white film.

Materials:

Developer, stop, fixer

2. Load Film into a Developing Tank

Activities:

- a. Read page 47 in Photography.
- b. Watch a demonstration on how to load a developing tank.
- c. Name the parts of your developing tank and tell how to load it.
- d. Practice loading the developing tank using scrap film.

Materials:

Scrap film, developing tank

3. Develop a Roll of Film

Activities:

- a. Watch a demonstration on how to develop a roll of film.
- b. Outline the steps in developing a roll of film.

- c. Practice pouring chemicals in and out of the tank.
- d. Watch the movie: Developing the Negative.

Materials:

Chemicals, developing tank

EVALUATION:

1. Develop the film you exposed in Lesson 3, using the correct chemicals and procedures. Submit the processed negatives to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Handling Film in the Darkroom					
Developing Negatives					
Preparing the Chemicals					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Contact Print Black and White Negatives

LEARNING OBJECTIVES:

1. Discuss the Chemicals and Equipment Used in Developing Black and White Contact Prints

Activities:

- a. Read pages 10 to 12 in Photography.
- b. Watch a demonstration on the chemicals and equipment used in developing black and white contact prints.
- c. On the worksheet, identify some of the equipment used in developing contact prints.
- d. Prepare the chemicals for developing contact prints.

Materials:

Dektol, stop bath, fixer

2. Outline the Procedure for Exposing Contact Prints

Activities:

- a. Read pages 22 to 25 in Photography.
- b. Watch a demonstration on how to expose contact prints.
- c. On the worksheet, outline the steps in exposing contact prints.

Materials:

None

3. Prepare Contact Prints

Activities:

- a. Watch a demonstration on how to prepare contact prints.

- b. Practice making contact prints by exposing scrap enlarging paper with the enlarger.
- c. Watch the movie: Darkroom Techniques.

Materials:

Enlarger, enlarging paper, glass, chemicals, timer

EVALUATION:

1. Make contact prints of the negatives you developed in Lesson 4. Submit the prints to your instructor for evaluation.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

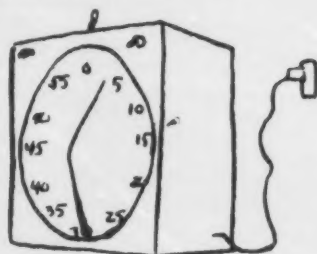
Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Identify the following equipment:



a. _____



b. _____



c. _____



d. _____

2. Outline the steps in exposing contact prints.

3. MULTIPLE CHOICE. The name of the developer for making contact prints is
(a) stop bath (b) microdol (c) dektol (d) water wash

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Preparing the Chemicals					
Setting-Up to Make the Prints					
Making Contact Prints					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Make Enlargements from Black and White
Negatives

LEARNING OBJECTIVES:

1. Discuss the Parts and Operation of the Enlarger

Activities:

- a. Read pages 54 to 56 in Photography.
- b. Watch a demonstration on the parts and operation of the enlarger.
- c. On the worksheet, identify the parts of an enlarger.
- d. Look at an enlarger and tell what each of the major parts do.
- e. Practice adjusting the enlarger.

Materials:

Enlarger

2. Outline the Chemicals and Procedures in Developing Enlarged
Black and White Prints

Activities:

- a. Read page 58 in Photography.
- b. Watch a demonstration on developing enlarged black and white prints.
- c. Compare the development of contact prints with the development of enlargements.

Materials:

None

3. Make a Test Strip and Enlargement

Activities:

- a. Read pages 56 to 58 in Photography.

- b. Watch a demonstration on how to make a test strip and enlargement.
- c. Look at a test strip and select the best exposure time for an enlargement.
- d. On the worksheet, outline how to make a test strip and enlargement.
- e. Practice making a test strip and enlargement.
- f. Watch the movie: Printing the Positive.

Materials:

Enlarger, enlarging paper, cardboard, negative, easel, timer, chemicals

EVALUATION:

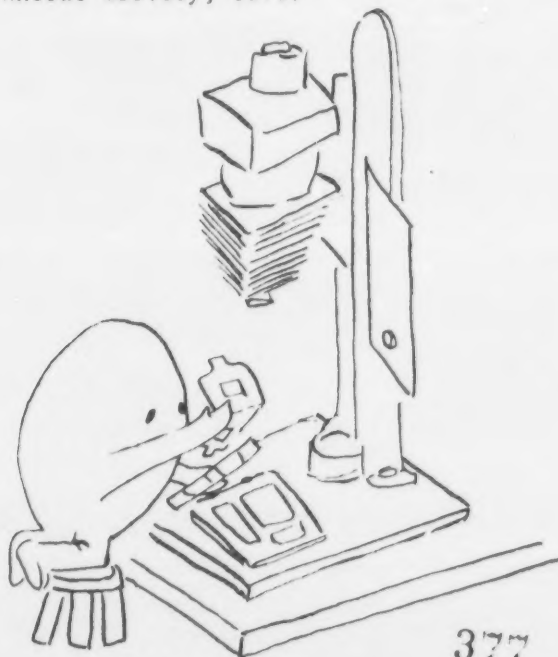
1. After viewing the contact prints made in Lesson 5, select the two best pictures for enlarging. Using the correct negatives, make each print 4 inches by 5 inches while watching for a good exposure and development.

Submit the final prints to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

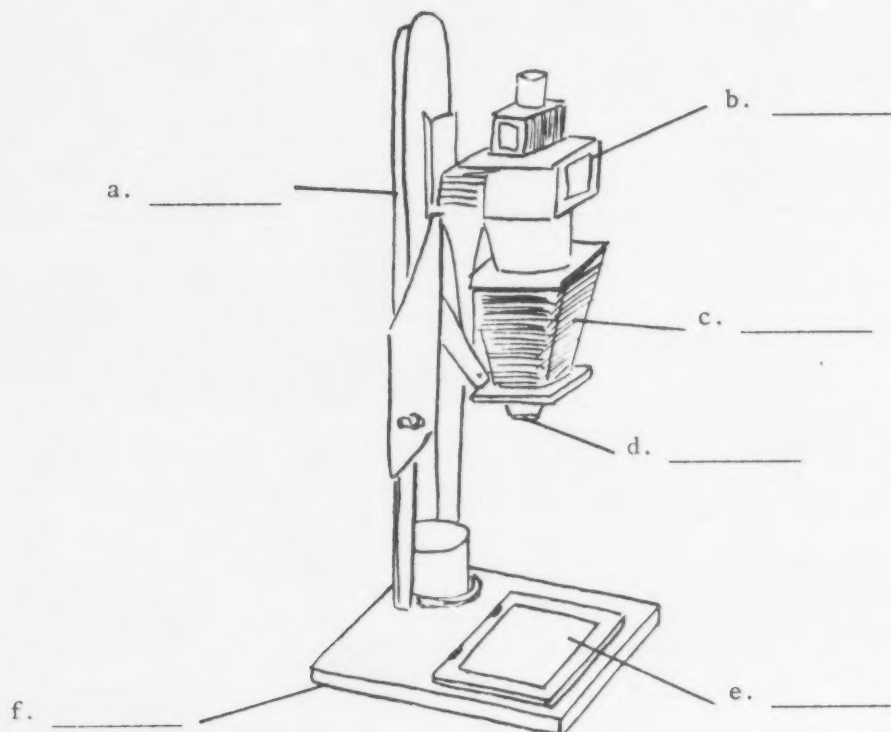
RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the parts of the following enlarger:



2. Outline how to make a test strip.

3. TRUE or FALSE. The longer you develop an enlarged print the darker it gets.
4. TRUE or FALSE. Raising and lowering the enlarger head brings the image into focus.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Operating the Enlarger					
Selecting Negatives to Enlarge					
Making Enlargements					
Preparing the Chemicals					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Make a Portrait Photograph

LEARNING OBJECTIVES:

1. Describe the Lighting for a Formal Portrait Photograph

Activities:

- a. Read pages 79 to 81 in Photography.
- b. Watch a demonstration on lighting for portrait photography.
- c. Describe the purpose of the four lights needed to take portraits.
- d. Practice arranging lights to get different effects with a portrait.
- e. Watch the movie: Basic Portrait Lighting.
- f. Watch the movie: Controlled Photographic Lighting.

Materials:

Lights, background

2. Explain How to Pose Someone for a Portrait Photograph

Activities:

- a. Watch a demonstration on posing for a portrait photograph.
- b. Practice posing someone in full length, half length and head-and-shoulders length.
- c. Tell how to pose someone to show a different personality.

Materials:

None

3. Tell How to Decide What Props to Use in a Portrait Photograph

Activities:

- a. Watch a demonstration on selecting props for a portrait photograph.
- b. Tell what props to use when photographing someone to show a different personality.
- c. On the worksheet, name some props.

Materials:

None

EVALUATION:

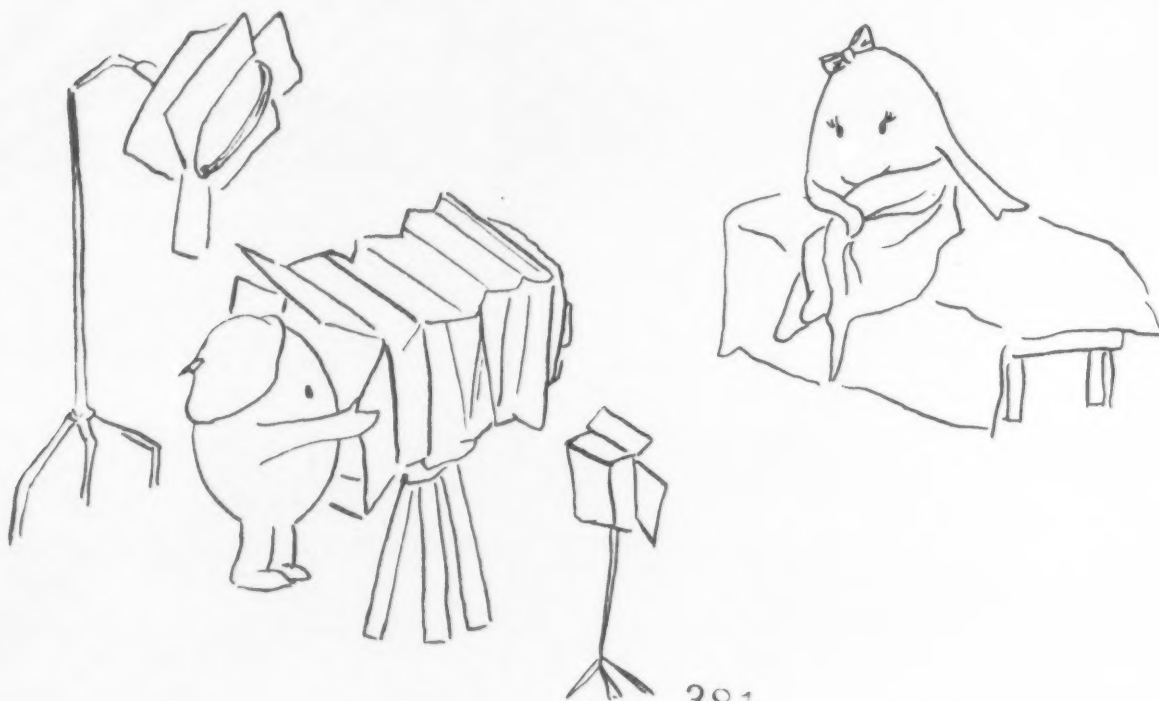
1. Identify three people and set-up portrait photographs of each. Consider lighting, pose and props. Expose the film, develop the film and make enlargements of the portraits.

Submit the final portrait photographs to your instructor for evaluation. (NOTE: This assignment may be done along with the photographs from Lessons 8, 9, and 10.)

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. In the following sketch, draw in the location of all light needed to take this portrait photograph:



2. Describe how much of a person should be seen in portrait photography.

3. Name the three main elements of portrait photography.

4. List six props which could be used when photographing someone.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Light a Portrait					
Posing Someone for a Portrait					
Selecting Props for a Portrait					
Taking Pictures of People					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Expose a Picture with Flash

LEARNING OBJECTIVES:

1. Name and Describe the Main Types of Flash

Activities:

- a. Read pages 82 to 84 in Photography.
- b. Watch a demonstration describing the main types of flash.
- c. Name the four main sources of artificial light.
- d. Describe why the flash must be fired when the shutter is open.

Materials:

None

2. Discuss the Three Ways Indoor Flash Pictures Are Made

Activities:

- a. Read pages 84 to 86 in Photography.
- b. Watch a demonstration on bounce flash, off-camera flash and on-camera flash.
- c. Describe the different methods of flash picture taking.
- d. Explain when to use the off-camera flash method.
- e. Practice directing the flash unit using the different methods.

Materials:

Flash unit

3. Compute f-Stops for Flash Photography

Activities:

- a. Read pages 83 to 84 in Photography.
- b. Watch a demonstration on computing f-stops for flash photography.
- c. Practice computing f-stops from flash bulb guide numbers.
- d. Practice computing f-stops with electronic flash calculators.
- e. Explain how to compute f-stops for bounce flash.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Using your flash unit, expose three different subjects indoors. Be sure you set the correct f-stop on your camera and use the proper flash technique. Develop the film and make enlargements of the flash pictures.

Submit the final flash photographs to your instructor for evaluation. (NOTE: This assignment may be done along with the photographs from Lessons 7, 9, and 10.)

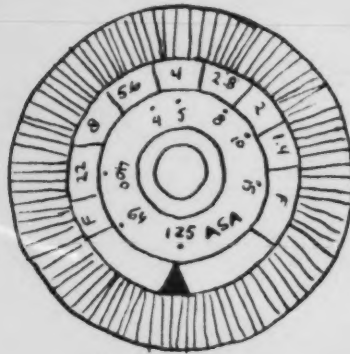
3. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Look at this flash computer and answer the questions that follow:



- a. What ASA value has been set? _____
- b. At a distance of 5 feet, what aperture setting should be used?
- _____

2. Name the four main sources of artificial light.

3. Draw a diagram showing the method for bounce flash. Explain how to compute f - stops with this method.

STUDENT ATTITUDE SHEET

for

CLUSTER _____

MANUFACTURING

UNIT _____

COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Use a Flash					
Computing f-Stops					
Taking Flash Pictures					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Make a Scenic Photograph

LEARNING OBJECTIVES:

1. Explain "Center of Interest" in a Scenic Photograph

Activities:

- a. Read pages 87 to 88 in Photography.
- b. Watch a demonstration on how to identify a good subject to photograph.
- c. Watch a demonstration on how to create a center of interest.
- d. Define "cropping".

Materials:

None

2. Describe Three Ways to Add Depth to Scenic Photographs

Activities:

- a. Read pages 88 to 92 in Photography.
- b. Watch a demonstration on framing, subject placement and lighting.
- c. Identify items used for framing in an assortment of photographs.
- d. Explain where to locate the center of interest in the picture.

Materials:

Assortment of photographs

EVALUATION:

1. Expose three scenic photographs. Develop the film and make enlargements.

Submit the final scenic photographs to your instructor for evaluation. (NOTE: This assignment may be done along with the photographs from Lessons 7, 8, and 10.)

2. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Photograph a Scenic					
Taking Scenic Photographs					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Commercial Photographer

OCCUPATIONAL COMPETENCY: Take Action Photographs

LEARNING OBJECTIVES:

1. Name and Describe Some Basic Techniques for Action Photography

Activities:

- a. Read pages 100 to 102 in Photography.
- b. Watch a demonstration on stopping action with the camera.
- c. Name some ways to stop action with the camera.
- d. Practice panning with the camera.
- e. Explain how a fast shutter speed will stop action.

Materials:

Camera

2. Discuss the Process of Pre-focusing

Activities:

- a. Read pages 101 to 102 in Photography.
- b. Watch a demonstration on pre-focusing for action photography.
- c. Explain the need for pre-focusing for action photography.
- d. Practice estimating distance for pre-focusing.

Materials:

None

EVALUATION:

1. Expose three subjects using the proper technique to stop action. Develop the film and make enlargements.

Submit the final action photographs to your instructor for evaluation. (NOTE: This assignment may be done along with the photographs from Lessons 7, 8, and 9.)

2. Complete the attitude sheet.

RESOURCES:

Lathrop, Irvin and LaCour, Marshall. Photography. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL PHOTOGRAPHER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How to Stop Action					
Taking Action Photographs					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

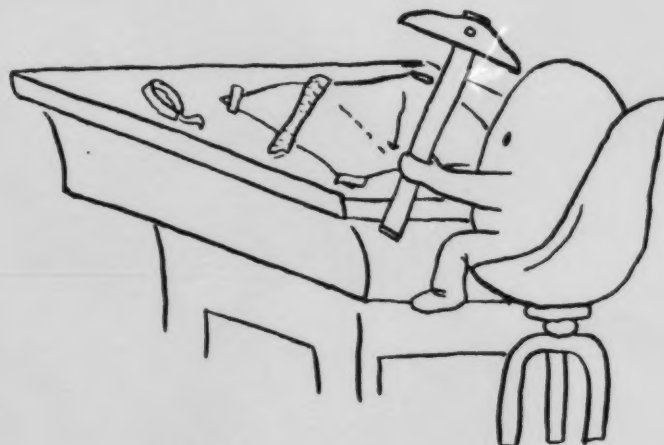
UNIT OF STUDY: Drafter

DOT OCCUPATIONAL CATEGORY: Professional, Technical and Managerial

DOT OCCUPATIONAL DIVISION: Architecture, Engineering and Surveying

DOT OCCUPATIONAL GROUP: Mechanical Engineering

OCCUPATIONAL OVERVIEW: The drafter draws detailed working drawings of machinery, mechanical devices, electrical circuits, architectural structures and similar industrial products. Indicates dimensions, tolerances, materials, joining requirements and other engineering data. Drafts multiple view drawings, assembly and layout drawings, sectional views, auxiliary views and pictorial illustrations, utilizes knowledge of various machines, engineering practices, mathematics, building materials and physical sciences to complete drawings.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

001.261-010	Drafter, Architectural
003.281-010	Drafter, Electrical
003.281-014	Drafter, Electronic
005.281-010	Drafter, Civil
007.261-018	Drafter, Patent
007.281-010	Drafter, Mechanical

LESSON 1

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Perform Correct Lettering

LEARNING OBJECTIVES:

1. Identify Correct Lettering Types

Activities:

- a. Read page 10 in Drafting.
- b. Watch a demonstration showing the difference between lettering types.
- c. On the worksheet, make a vertical letter "A". Next to it, make a slanted letter "A".
- d. Watch the movie: Drafting - Curves and Lettering.

Materials:

Pencil

2. Make Vertical Gothic Letters

Activities:

- a. Read pages 11 to 12 in Drafting.
- b. Watch a demonstration showing how to make vertical, single stroke gothic letters.
- c. Practice making vertical single stroke gothic letters.

Materials:

Paper, pencil

3. Describe How to Space Words and Letters

Activities:

- a. Watch a demonstration on how to space words and letters.
- b. Practice printing words and watching spacing.

Materials:

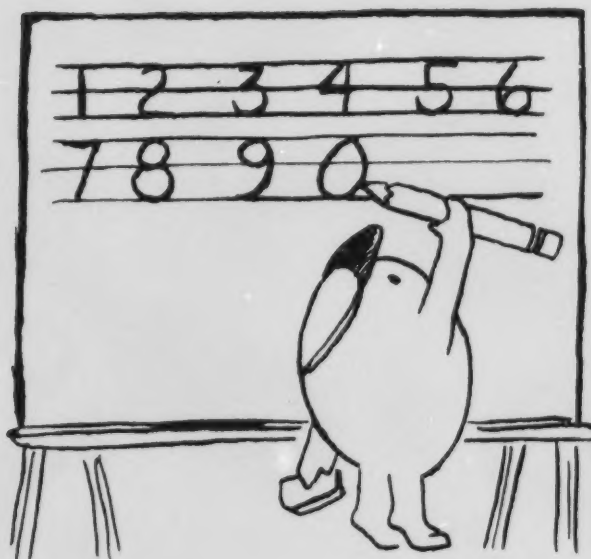
Paper, pencil

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. In the space provided, make a vertical letter "A" and a slanted letter "A".

vertical

slanted

2. On the lines provided, practice making the vertical single stroke gothic letters shown.

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y
1	2	3	4	
5	6	7	8	9

3. On the lines provided, practice word and letter spacing by printing the phrase "PRACTICE MAKES SPACING EASY".

STUDENT ATTITUDE SHEET

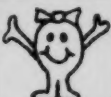
for

CLUSTER MANUFACTURING

UNIT _____

DRAFTER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Letter with Different Styles					
Seeing How to Space Letters and Words					
Lettering Very Neatly					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Discuss Drafting Tools

LEARNING OBJECTIVES:

1. Discuss Drafting Pencils and Pens

Activities:

- a. Read pages 14 to 16 in Drafting.
- b. Watch a demonstration showing the different drafting pencils and pens and telling their uses.
- c. Identify the grade of a drafting pencil provided by the teacher.
- d. On the worksheet, tell why there are light lines and dark lines on a drawing.

Materials:

Drafting pencils

2. Discuss Drafting Papers

Activities:

- a. Read pages 17 to 18 in Drafting.
- b. Watch a demonstration showing the five types of drafting paper and their uses.
- c. On the worksheet, list the five types of drafting paper and tell what they are used for.

Materials:

None

3. Use Drafting Tools

Activities:

- a. Read pages 19 to 25 in Drafting.

- b. Watch a demonstration identifying the drafting tools and showing how they are used.
- c. From an assortment of drafting tools, identify each tool and tell what it is used for.
- d. Practice using each tool shown by your instructor.
- e. Watch the movies: Essentials of Drafting, Pt. 1.
Essentials of Drafting, Pt. 2.
Essentials of Drafting, Pt. 3.

Materials:

Assortment of drafting tools

EVALUATION:

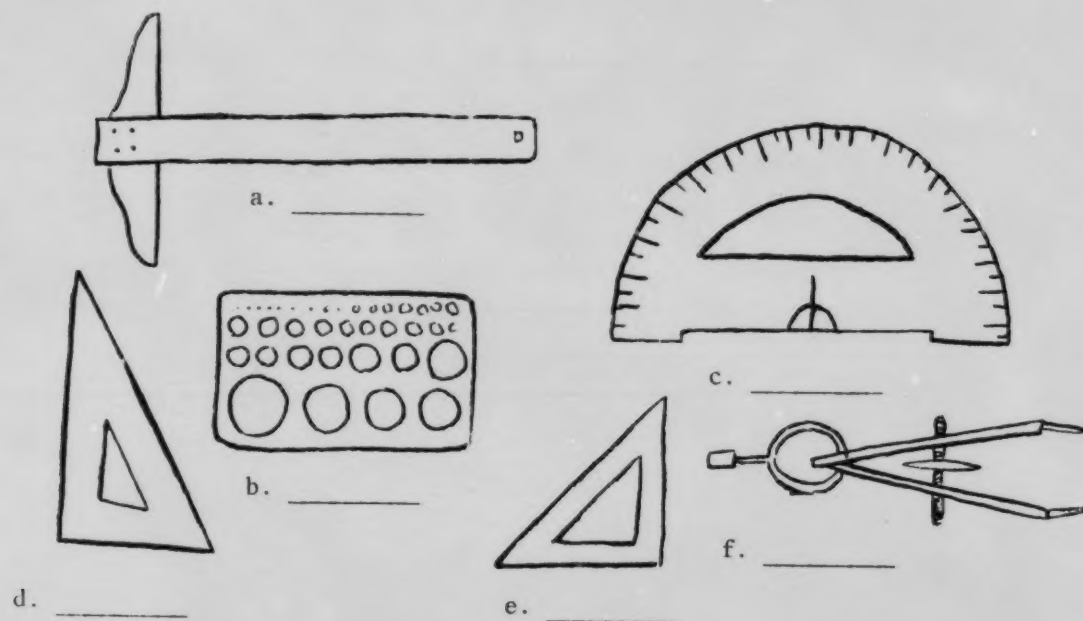
1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. List the five types of drafting paper. Tell what each is used for.
2. TRUE or FALSE. A 3H drafting pencil is harder than a 5B drafting pencil.
3. Why are there light lines and dark lines on a drawing.
4. Identify the following drafting tools:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out What Various Pencils are Used For					
Learning About Different Drafting Paper					
Seeing How the Drafting Tools are Used					
Using Drafting Tools					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Demonstrate Measurement Skills

LEARNING OBJECTIVES:

1. Use the Mechanical Drafting Scale

Activities:

- a. Read pages 26 to 27 in Drafting.
- b. Watch a demonstration on the use of the mechanical drafting scale.
- c. On the worksheet, tell what is meant by a full scale drawing.
- d. Practice measuring things with the mechanical drafting scale.

Materials:

Mechanical drafting scale

2. Discuss the Metric System of Measurement

Activities:

- a. Read pages 34 to 37 in Drafting.
- b. Watch a demonstration describing the metric system of measurement.
- c. Watch the movie: Measure Length, Think Metric.

Materials:

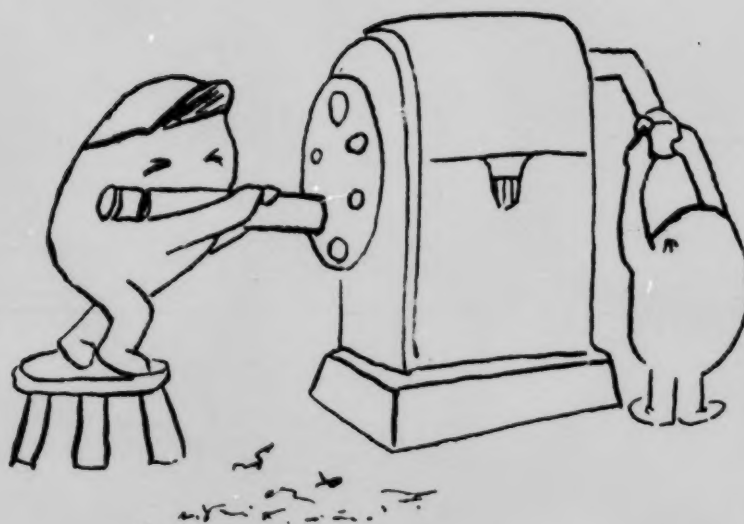
None

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

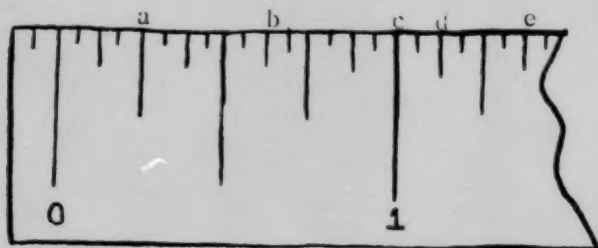
RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.



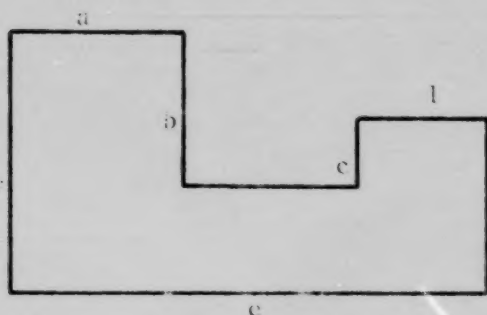
WORKSHEET

1. Identify the length shown by the letters on the following scale:



- a. _____
 b. _____
 c. _____
 d. _____
 e. _____

2. Use a mechanical scale to measure the lengths shown by the letters on the following drawing:



- a. _____
 b. _____
 c. _____
 d. _____
 e. _____
 f. _____

3. List the metric units for measuring length.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using the Mechanical Drafting Scale					
Knowing How to Measure Using the Metric System					
Measuring Things					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Complete a Sheet Layout

LEARNING OBJECTIVES:

1. Identify the Parts of a Sheet Layout

Activities:

- a. Read page 43 in Drafting.
- b. Watch a demonstration on the parts of a sheet layout.
- c. On the worksheet, name the parts of a sheet layout.
- d. On the worksheet, define size A and size B paper.
- e. Watch the movie: Drafting Tips.

Materials:

None

2. Layout an 8½" x 11" Sheet

Activities:

- a. Read pages 43 to 44 in Drafting.
- b. Watch a demonstration showing how to layout an 8½" x 11" sheet.
- c. On the worksheet, list the information included in most title strips on a sheet layout.

Materials:

None

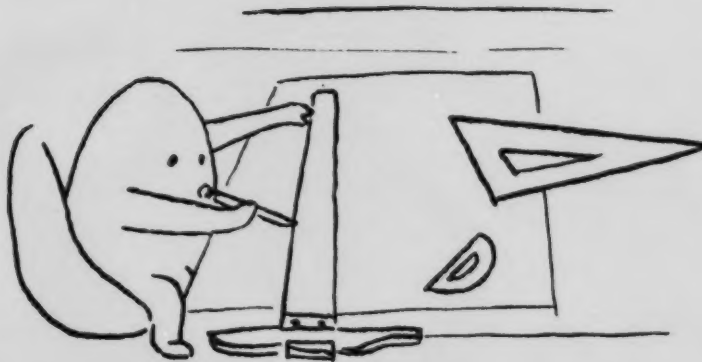
EVALUATION:

1. Attach a sheet of 8½" x 11" drafting paper to your drafting board and layout the sheet using the form presented by your instructor. Use drafting tools to complete the job and submit it to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Name the parts of a sheet layout.
2. Define size A and size B paper.
3. List the information included in most title strips on a sheet layout.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing the Purpose of a Sheet Layout					
Laying-Out a Sheet to a Specific Form					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Perform Geometric Constructions

LEARNING OBJECTIVES:

1. Complete Basic Geometric Constructions Using Drafting Tools

Activities:

- a. Read pages 46 to 53 in Drafting.
- b. Watch a demonstration on how to perform various geometric constructions.
- c. On the worksheet, identify some basic geometric shapes.

Materials:

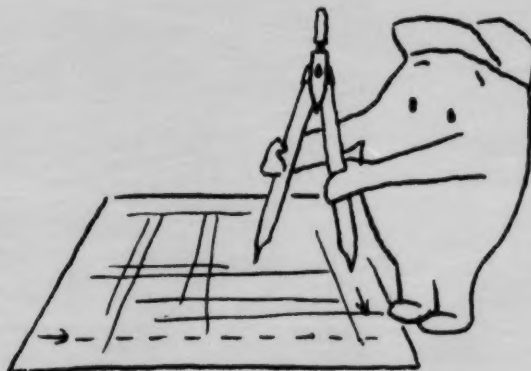
None

EVALUATION:

1. Attach the worksheet to your drafting board and complete the exercises. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the following shapes:



a. _____



b. _____



c. _____



d. _____

2. Perform the following geometric constructions.



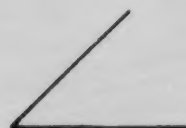
a. Draw a perpendicular line
from a point on a line



b. Bisect a line with
a compass



c. Draw a line parallel
to another line



d. Bisect an angle with
a compass



e. Draw an equilateral
triangle



f. Draw an octagon inside
a square

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using Drafting Tools to Perform Geometric Constructions					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Complete a One-View Drawing

LEARNING OBJECTIVES:

1. Center a One-View Drawing

Activities:

- a. Watch a demonstration on how to center a one-view drawing on a sheet.
- b. Practice figuring the spacing needed to center different objects on your drafting sheet.

Materials:

None

2. Complete a One-View Drawing

Activities:

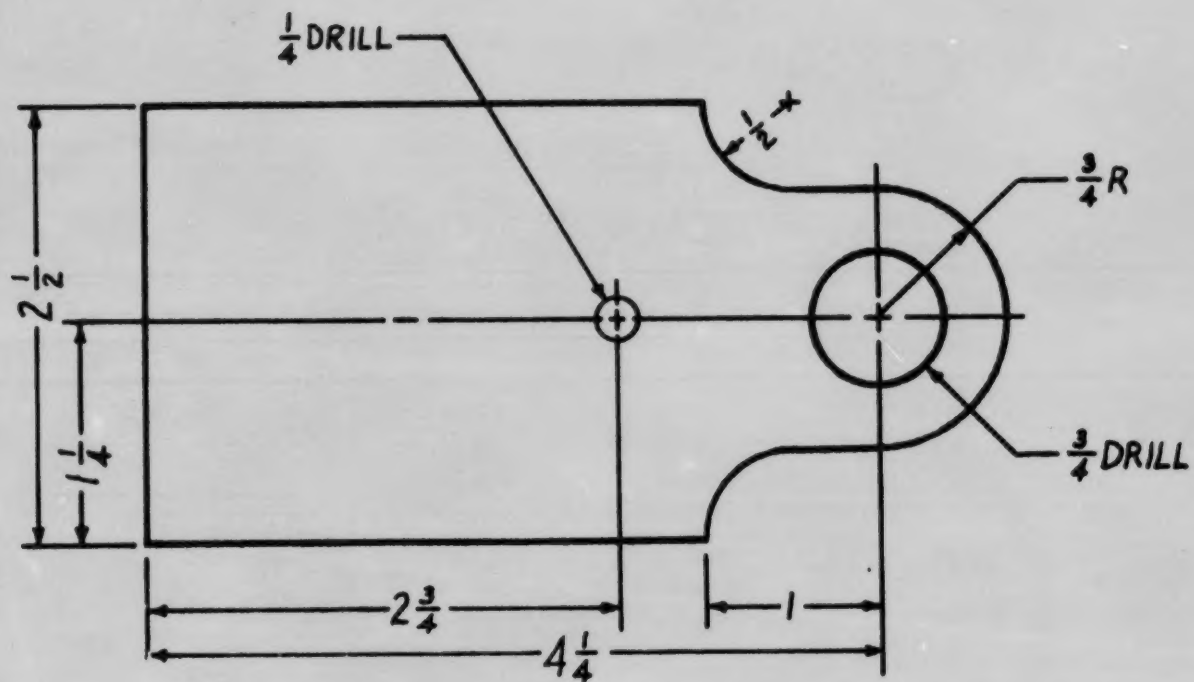
- a. Watch a demonstration on how to draw a one-view drawing.
- b. Review Lessons 1 to 5 for help in doing a one-view drawing.

Materials:

None

EVALUATION:

1. Attach a sheet of $8\frac{1}{2}$ " x 11" drafting paper to your board and complete a sheet layout. Make a one-view drawing of the following gasket:



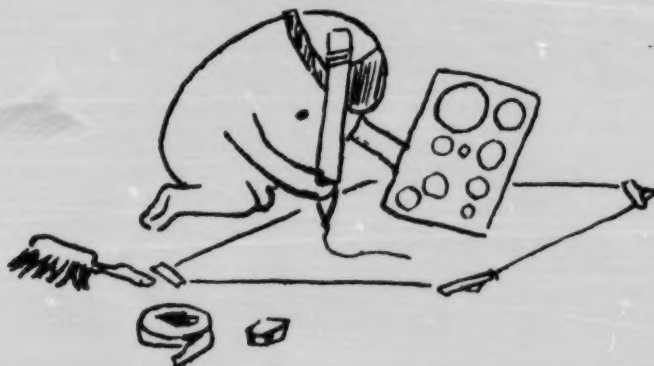
GASKET

Submit the completed one-view drawing to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

None



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Draw an Object					
Centering a One-View Drawing on a Page					
Making a One-View Drawing of an Object					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Complete a One-View Sketch

LEARNING OBJECTIVES:

1. Sketch Straight Lines

Activities:

- a. Read Figures 25-3 to 25-5 on page 114 in Drafting.
- b. Watch a demonstration on how to sketch a straight line.
- c. On scrap paper, practice sketching straight lines.

Materials:

Scrap paper, pencil

2. Sketch Circles and Arcs

Activities:

- a. Read Figures 25-6 to 25-7 on page 114 in Drafting.
- b. Watch a demonstration on how to sketch circles and arcs.
- c. On scrap paper, practice sketching circles and arcs.

Materials:

Scrap paper, pencil

3. Use Graph Paper in Sketching

Activities:

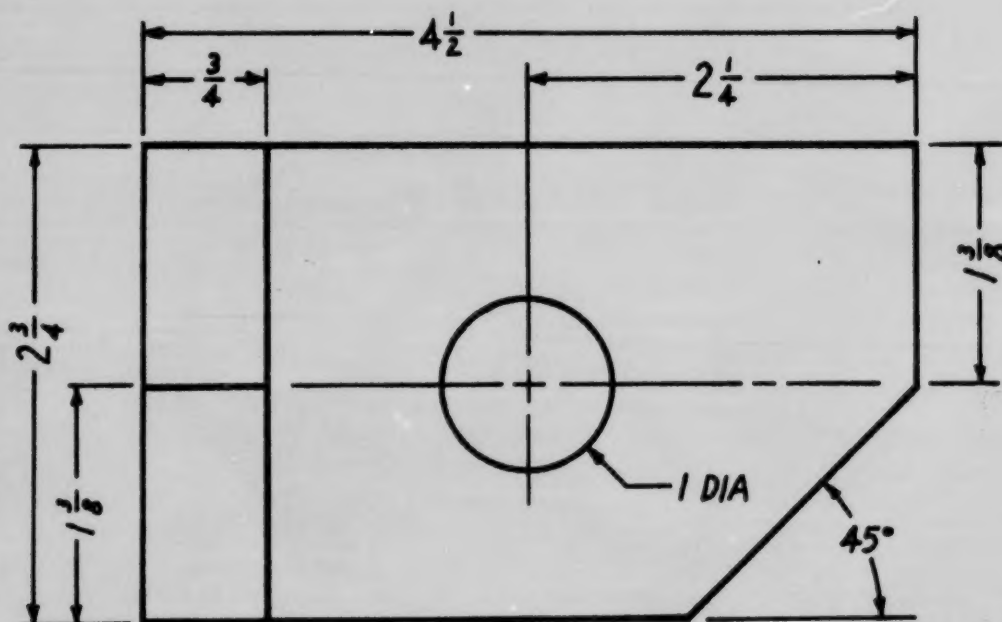
- a. Read page 116 in Drafting.
- b. Watch a demonstration on how to sketch an object on graph paper.
- c. Using graph paper, practice sketching objects found in the room.

Materials:

Square grid graph paper, pencil

EVALUATION:

1. Using a sheet of square grid graph paper, complete a one-view sketch of the following flange:



FLANGE

Submit the completed sketch to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Sketching Straight Lines					
Sketching Arcs and Circles					
Using Graph Paper to Sketch an Object					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Complete a Two-View Drawing

LEARNING OBJECTIVES:

1. Center a Two-View Drawing

Activities:

- a. Watch a demonstration on how to center a two-view drawing.
- b. Practice figuring the spacing needed to center different objects on your drafting sheet.

Materials:

Paper, pencil

2. Complete a Two-View Drawing.

Activities:

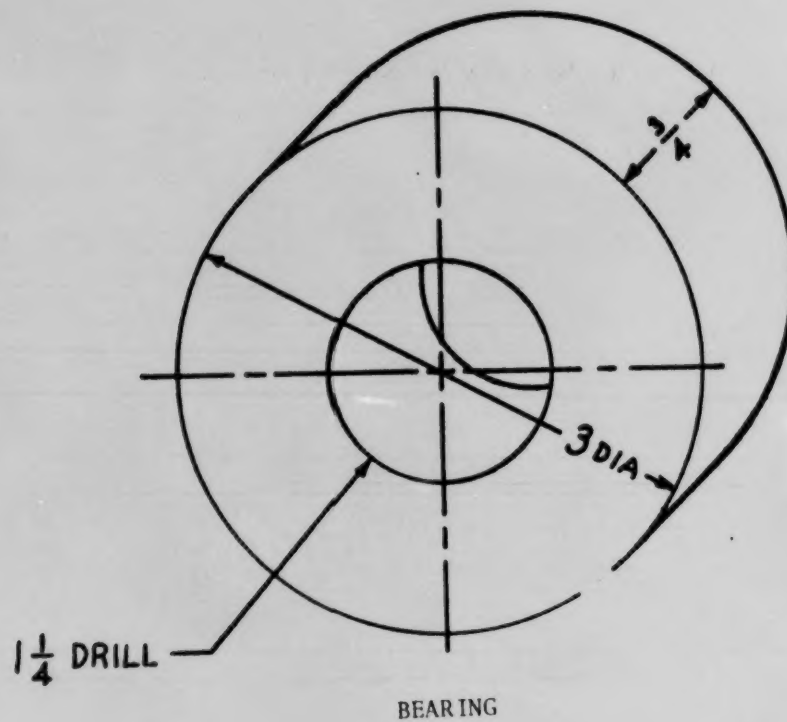
- a. Watch a demonstration on how to do a two-view drawing.
- b. Practice sketching the front and side views of different objects in your room.

Materials:

Paper, pencil

EVALUATION:

1. Attach a sheet of 8½" x 11" drafting paper to your board and complete a sheet layout. Make a two-view drawing of the following bearing:



Submit the completed two-view drawing to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

None

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Draw Two Views of an Object					
Centering a Two-View Drawing on a Page					
Drawing an Object in Two Views					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Complete a Three-View Drawing

LEARNING OBJECTIVES:

1. Center a Three-View Drawing

Activities:

- a. Watch a demonstration on how to center a three-view drawing.
- b. Practice figuring the spacing needed to center various three-view drawings on your drafting sheet.

Materials:

Paper, pencil

2. Complete a Three-View Drawing

Activities:

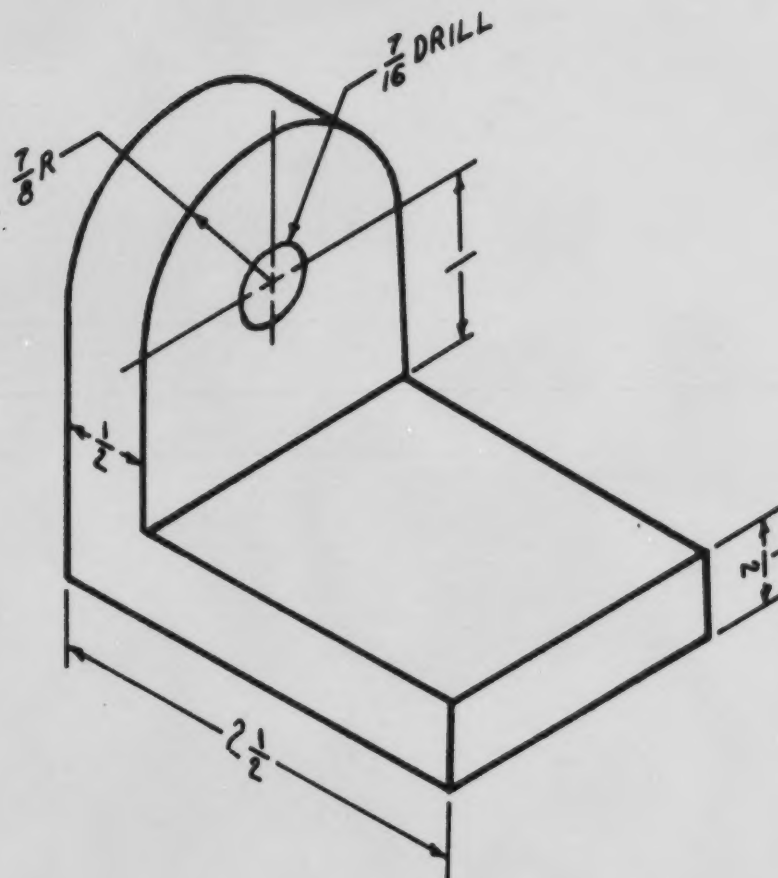
- a. Read pages 56 to 59 in Drafting.
- b. Watch a demonstration on completing a three-view drawing.
- c. Practice sketching the front, top and side views of different objects in your room.
- d. Watch the movie: Multiview Drawing.
- e. Watch the movie: Orthographic Projection.

Materials:

Paper, pencil

EVALUATION:

1. Attach a sheet of 8½" x 11" drafting paper to your board and complete a sheet layout. Make a three-view drawing of the following bracket:



BRACKET

Submit the completed three-view drawing to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ DRAFTER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Draw Three Views of an Object					
Centering a Three-View Drawing on a Page					
Drawing an Object in Three Views					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Drafter

OCCUPATIONAL COMPETENCY: Add Dimensions to a Drawing

LEARNING OBJECTIVES:

1. Identify the Parts of a Dimension

Activities:

- a. Read page 63 in Drafting.
- b. Watch a demonstration identifying the parts of a dimension.
- c. On scrap paper, practice making good arrowheads.

Materials:

Scrap paper, pencil

2. Tell How to Apply Dimensions to a Drawing

Activities:

- a. Read pages 63 to 65 in Drafting.
- b. Watch a dimension on how to locate and apply dimensions to a drawing.
- c. Watch the movie: Selection of Dimensions.

Materials:

None

3. Describe How to Dimension Various Forms and Shapes

Activities:

- a. Read pages 64 to 68 in Drafting.
- b. Watch a demonstration on how to dimension various forms and shapes.
- c. Watch the movie: Size Description.

Materials:

None

EVALUATION:

1. Apply all necessary dimensions to the three-view drawing prepared in Lesson 9. Submit the completed drawing to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Wallach, Paul I. Drafting. Chicago, Illinois, American Technical Society, 1979.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT DRAFTER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing Why Dimensions are Added to a Drawing					
Adding Dimensions to a Drawing					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

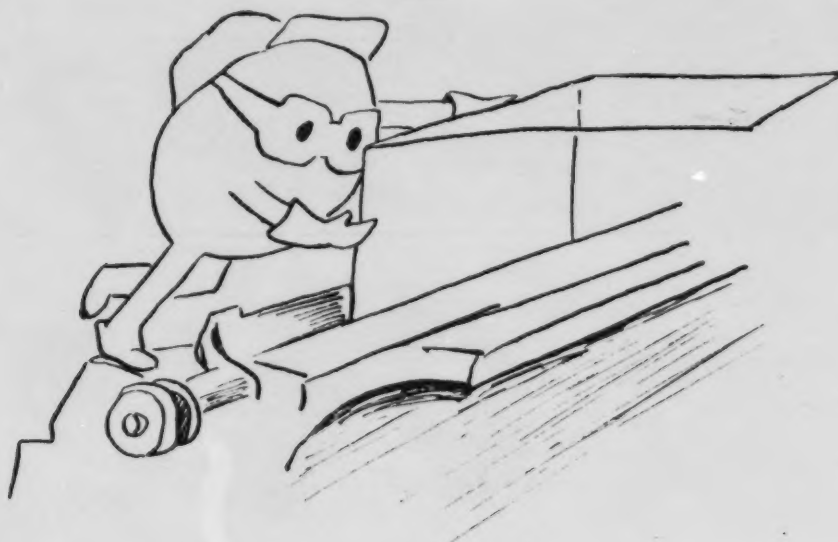
UNIT OF STUDY: Sheet Metal Worker

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Metal Fabricating

DOT OCCUPATIONAL GROUP: Tinsmiths, Coppersmiths and Sheet Metal Workers

OCCUPATIONAL OVERVIEW: The sheet metal worker fabricates, assembles, installs and repairs sheet metal products and equipment such as control boxes, drainpipes, ventilators and furnace casings. Selects metal and shapes it according to job order or blueprints. Sets up and operates fabricating machines, welding equipment and finishing equipment. Inspects assemblies with precision measuring equipment.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

804.281-010	Sheet Metal Worker
804.481-010	Hood Maker
616.360-018	Sheet Metal Fabricating Machine Operator
730.684-074	Sheet Metal Pattern Cutter
619.685-062	Sheet Metal Production Worker

LESSON 1

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Describe Sheet Metal Patterns and Their Layout

LEARNING OBJECTIVES:

1. Identify the Four Methods of Pattern Development

Activities:

- a. Read page 176 in Technical Metals.
- b. Watch a demonstration on patterns and pattern development.
- c. Look at some patterns provided by the instructor and identify how each were developed.
- d. Watch the movie: Sheet Metal - Pattern Development.

Materials:

Instructor prepared patterns

2. Tell How to Layout a Pattern for a Box

Activities:

- a. Read pages 174 to 176 in Technical Metals.
- b. Watch a demonstration on patterns and pattern development.
- c. Define hem, wired edge, and seam on the worksheet.
- d. Sketch the development of a simple box on the worksheet.

Materials:

Pencil

3. Outline How to Develop a Cylinder

Activities:

- a. Read page 176 in Technical Metals.

- b. Watch a demonstration on patterns and pattern development.
- c. Sketch the development of a simple cylinder on the worksheet.

Materials:

Pencil

EVALUATION:

- 1. Complete the worksheet and submit it to your instructor for evaluation.
- 2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Define the following terms:

- a. Hem
- b. Wired Edge
- c. Seam
- d. Notch

2. Sketch the development of a simple box. Label the following:

- | | | |
|-----------|--------------|---------------|
| a. bottom | c. hem | e. fold lines |
| b. sides | d. seam tabs | |

3. Sketch the development of a simple cylinder.

4. Name the four methods of pattern development:

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing Why Patterns Are Used in Sheet Metal Work					
Learning How Patterns Are Developed					
Knowing How to Layout a Box and a Cylinder of a Specific Size					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Layout a Sheet Metal Pattern

LEARNING OBJECTIVES:

1. Develop a Pattern

Activities:

- a. Review Lesson 1, Learning Objective 2.
- b. Look at some sheet metal box projects which you can make.
- c. Tell how some of the patterns for these projects were developed.

Materials:

Sheet metal projects

EVALUATION:

1. Select a sheet metal box-type project from your book or from your instructor. Layout a full-size pattern for the box on craft paper. Submit the pattern to your instructor for evaluation on accuracy, squareness, and completeness.
2. Complete the attitude sheet.

RESOURCES:

None

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Selecting a Sheet Metal Project to Make					
Making a Pattern for a Sheet Metal Project					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Cut Sheet Metal to Size

LEARNING OBJECTIVES:

1. Transfer a Sheet Metal Pattern

Activities:

- a. Read page 45 in Metalworking/Little.
- b. Watch a demonstration on transferring patterns to sheet metal.
- c. Define scratch awl on the worksheet.
- d. Practice transferring a pattern on scrap sheet metal.

Materials:

Scratch awl, pattern, sheet metal

2. Discuss the Various Sheet Metal Snips

Activities:

- a. Read pages 47 to 48 in Metalworking/Little.
- b. Watch a demonstration on identifying and using sheet metal snips.
- c. From an assortment of snips, identify each type and its use.
- d. Practice cutting with the snips on scrap sheet metal.
- e. Watch the movie: Blanking Sheet Metal with Hand Snips.

Materials:

Straight snips, aviation snips, hawk-bill snips, scrap sheet metal

3. Operate the Squaring Shears

Activities:

- a. Read page 48 in Metalworking/Little.
- b. Watch a demonstration on how to use the squaring shears.
- c. On the worksheet, explain how to adjust the back gage.
- d. Practice using the squaring shears with scrap sheet metal.
- e. Watch the movie: Blanking Sheet Metal on the Squaring Shear.

Materials:

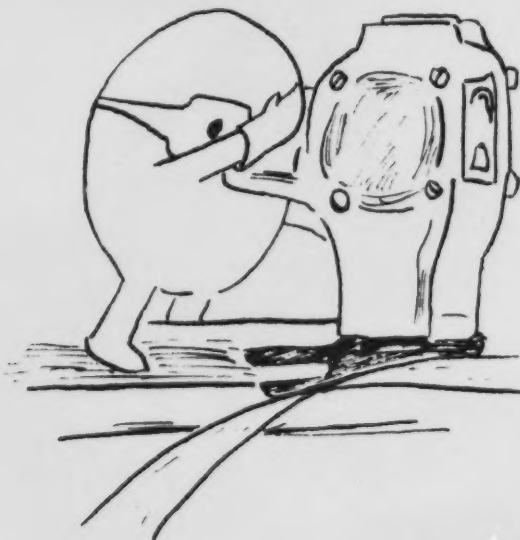
Squaring shears, scrap sheet metal

EVALUATION:

1. Using the pattern developed in Lesson 2, transfer the layout to a piece of sheet metal provided by your instructor. Cut the workpiece to size using the squaring shears and snips. Submit the finished piece and the pattern to your instructor for evaluation.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Little, Richard and Sherry. Metalworking. Chicago, Illinois, American Technical Society, 1979.

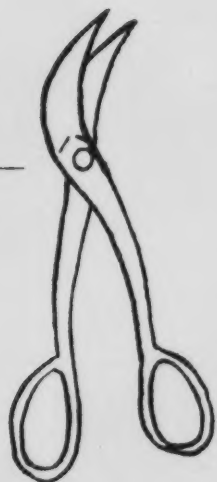


WORKSHEET

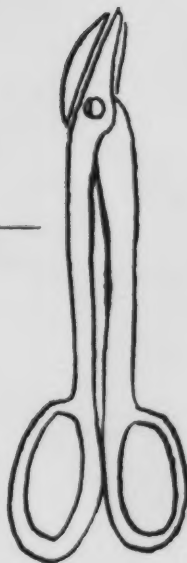
1. Define scratch awl.

2. Identify the following tools:

a. _____



b. _____



c. _____



3. Explain how to adjust the back gage of the squaring shears.

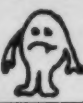
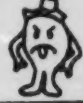
4. How do you cut an inside hole on a sheet metal project?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Transferring Your Pattern to Sheet Metal					
Seeing What Different Snips Do					
Cutting Out Your Sheet Metal Project					
Using the Squaring Shears and Snips					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Bend Sheet Metal with Hand Tools

LEARNING OBJECTIVES:

1. Describe the Various Metal Stakes

Activities:

- a. Read pages 183 to 184 in Technical Metals.
- b. Watch a demonstration on identifying and using metal stakes.
- c. From an assortment of stakes, identify some of them and tell what each is used for.

Materials:

Assortment of metal stakes

2. Make Angled Bends by Hand

Activities:

- a. Read page 184 in Technical Metals.
- b. Watch a demonstration on how to bend sheet metal by hand.
- c. On the worksheet, tell two ways to bend sheet metal by hand.
- d. Practice bending scrap sheet metal by hand.

Materials:

Blocks of wood, vise, mallet, hatchet stake, scrap sheet metal

3. Make Round Bends by Hand

Activities:

- a. Read page 185 in Technical Metals.

- b. Watch a demonstration on how to make cylindrical shapes by hand.
- c. Practice making cylindrical shapes on scrap sheet metal.

Materials:

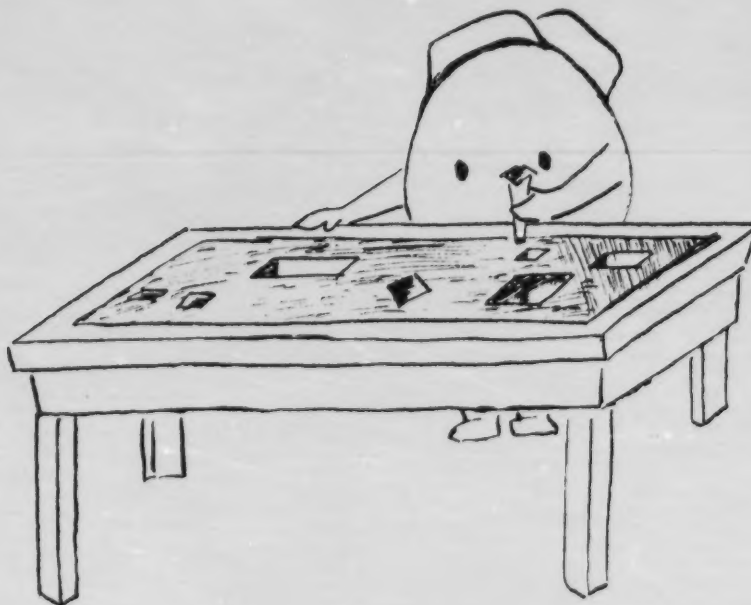
Scrap sheet metal, metal stakes, mallet

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

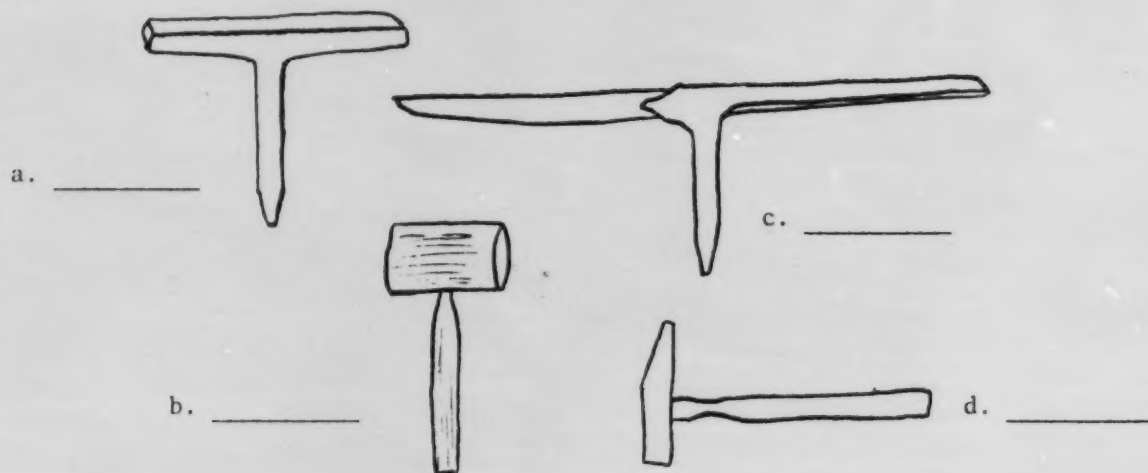
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Identify these tools:



2. Explain two ways to bend sheet metal by hand.

3. TRUE or FALSE. When making bends or curves in sheet metal, never hit it with a mallet as it will leave dents.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What Metal Stakes Are Used For					
Seeing How to Bend Metal By Hand					
Bending Sheet Metal With Hand Tools					
Using Metal Stakes					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Bend Metal on a Bar Folder

LEARNING OBJECTIVES:

1. Discuss the Various Sheet Metal Hems

Activities:

- a. Read pages 186 to 187 in Technical Metals.
- b. Watch a demonstration on the identification and use of sheet metal hems.
- c. Look around the room for sheet metal objects and identify the hems that were used.

Materials:

Objects around the room

2. Identify the Parts of the Bar Folder

Activities:

- a. Read page 186 in Technical Metals.
- b. Watch a demonstration on the parts and operation of the bar folder.
- c. On the worksheet, identify the major parts of the bar folder.

Materials:

Bar folder

3. Operate the Bar Folder

Activities:

- a. Read page 186 to 187 in Technical Metals.
- b. Watch a demonstration on the parts and operation of the bar folder.

- c. On the worksheet, tell what types of bends can be made with the bar folder.
- d. Practice using the bar folder on scrap sheet metal.

Materials:

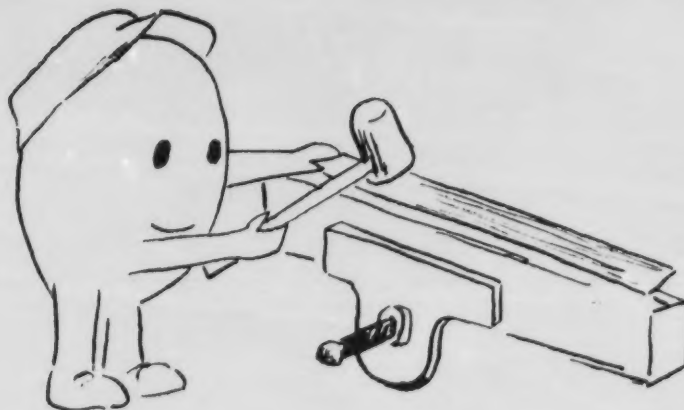
Bar folder, scrap sheet metal

EVALUATION:

1. Using the workpiece prepared in Lesson 3, make $\frac{1}{4}$ " single hems on all necessary edges with the bar folder. Submit the hemmed workpiece to your instructor for evaluation on accuracy.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

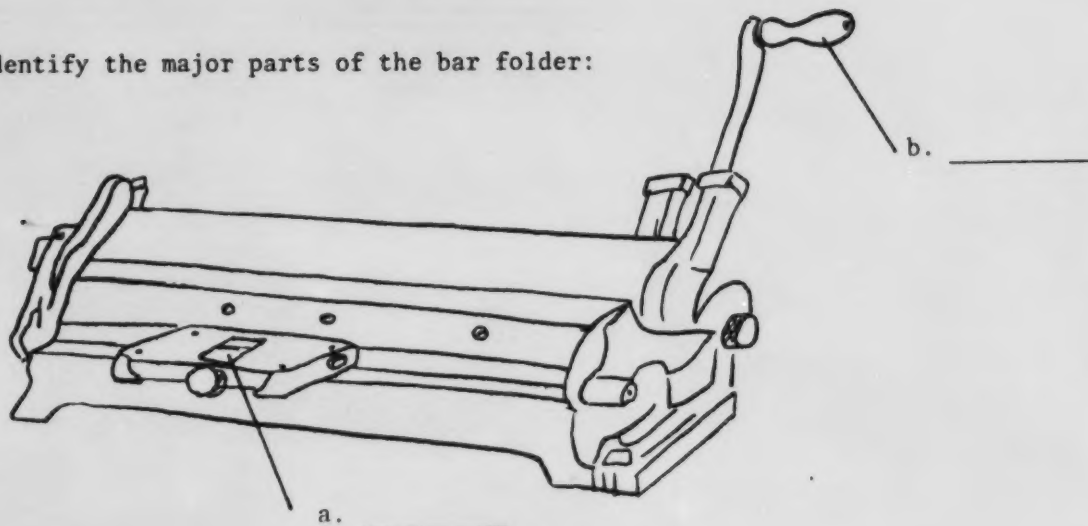
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Identify the major parts of the bar folder:



2. Draw the different bends which can be made on the bar folder.

3. TRUE or FALSE. On the bar folder, the amount of bend to be made is set on the depth gage.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning Why Hems Are Used in Sheet Metal					
Knowing About the Parts of the Bar Folder					
Seeing What the Bar Folder Is Used For					
Forming Hems With the Bar Folder					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Bend Metal on a Brake

LEARNING OBJECTIVES:

1. Name the Two Types of Sheet Metal Brakes

Activities:

- a. Read pages 50 to 51 in Metalworking/Little.
- b. Watch a demonstration on sheet metal brakes and their use.
- c. Look at the sheet metal brakes in the shop and identify them by type.
- d. Watch the movie: Forming on a Hand Operated Brake.

Materials:

Sheet metal brakes

2. Use the Cornice Brake

Activities:

- a. Read pages 50 to 51 in Metalworking/Little.
- b. Watch a demonstration on sheet metal brakes and their use.
- c. On the worksheet, name the parts of the cornice brake and tell how to use it.
- d. Practice using the cornice brake by bending scrap sheet metal.

Materials:

Cornice brake, scrap sheet metal

3. Use the Box and Pan Brake

Activities:

- a. Read pages 51 to 52 in Metalworking/Little.

- b. Watch a demonstration on sheet metal brakes and their use.
- c. On the worksheet, name the parts of the box and pan brake and tell how to use it.
- d. Practice using the box and pan brake by bending scrap sheet metal.

Materials:

Box and pan brake, scrap sheet metal

EVALUATION:

1. Using the workpiece you hemmed in Lesson 5, bend the sides and joints of the project using a sheet metal brake. Some of the bends can be made using hand tools.

Submit the formed workpiece to the instructor for evaluation.

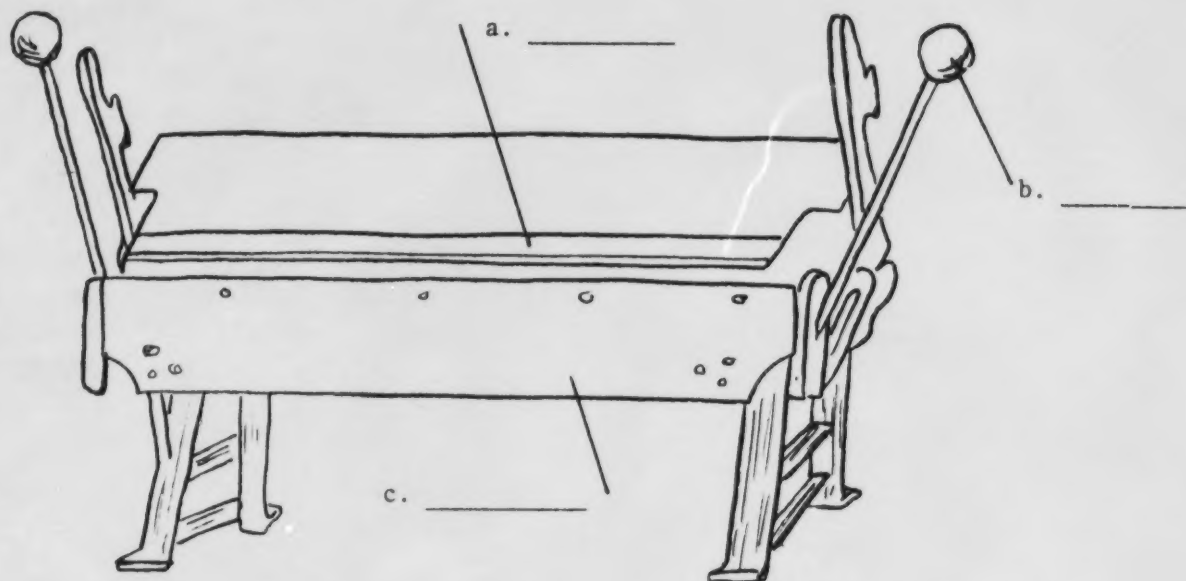
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

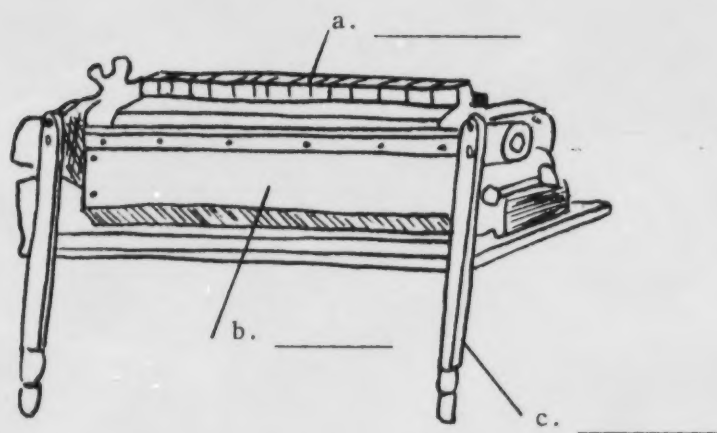
Little, Richard and Sherry. Metalworking. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Identify the parts of the cornice brake:



2. Identify the parts of the box and pan brake:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing What a Cornice Brake Does					
Knowing What a Box and Pan Brake Is Used For					
Bending Sheet Metal With a Cornice Brake					
Bending Sheet Metal With a Box and Pan Brake					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Roll Form Sheet Metal

LEARNING OBJECTIVES:

1. Identify the Parts of the Roll Forming Machine

Activities:

- a. Read page 188 in Technical Metals.
- b. Watch a demonstration on the parts and operation of the roll forming machine.
- c. On the worksheet, name the major parts of the roll forming machine.

Materials:

Roll forming machine

2. Form a Cylinder on the Roll Forming Machine

Activities:

- a. Read page 188 in Technical Metals.
- b. Watch a demonstration on the parts and operation of the roll forming machine.
- c. On the worksheet, tell why some of the rollers have grooves cut in them.
- d. Practice making round shapes with the roll forming machine by using scrap sheet metal.

Materials:

Roll forming machine, scrap sheet metal

EVALUATION:

1. Get a 5" x 12" piece of sheet metal from your instructor. Form a 5" tall cylinder using the roll forming machine.

Submit the finished cylinder to your instructor for evaluation.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

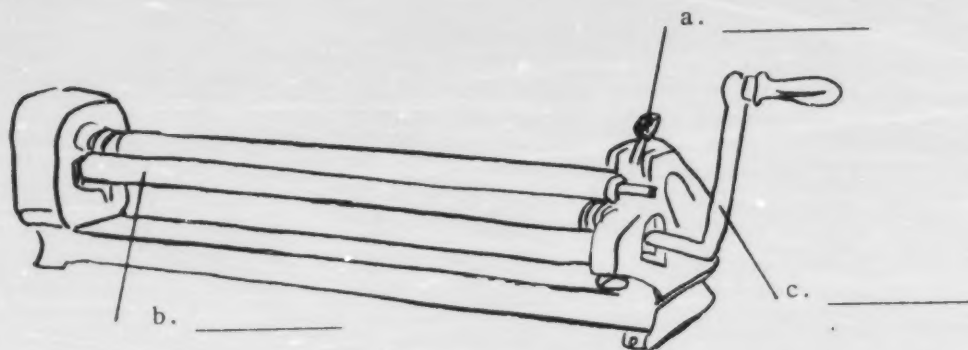
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Identify the major parts of the roll forming machine:



2. Why do some rollers have grooves in them?

3. Why is the upper roller removeable?

4. TRUE or FALSE. To form a sharp bend on sheet metal, use the roll forming machine.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing What a Roll Forming Machine Does					
Learning the Parts of the Roll Forming Machine					
Forming a Cylinder With the Roll Forming Machine					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Discuss Sheet Metal Seams

LEARNING OBJECTIVES:

1. List the Various Sheet Metal Seams

Activities:

- a. Read pages 190 to 194 in Technical Metals.
- b. Watch a demonstration on the types of sheet metal seams.
- c. Look at some sheet metal objects and tell what type of seam was used.

Materials:

Sheet metal objects

2. Tell About the Preparation of the Various Sheet Metal Seams

Activities:

- a. Read pages 190 to 194 in Technical Metals.
- b. Watch a demonstration on how sheet metal seams are made.
- c. On the worksheet, tell how some seams can be made either by hand or by machine.
- d. Practice making a grooved seam on scrap sheet metal.

Materials:

Scrap sheet metal, bar folder, mandrel stake, mallet, hand groover

3. Discuss the Use of the Various Sheet Metal Seams

Activities:

- a. Read pages 190 to 194 in Technical Metals.

- b. Watch a demonstration on the uses of sheet metal seams.
- c. On the worksheet, explain why some seams are better for certain jobs than others.

Materials:

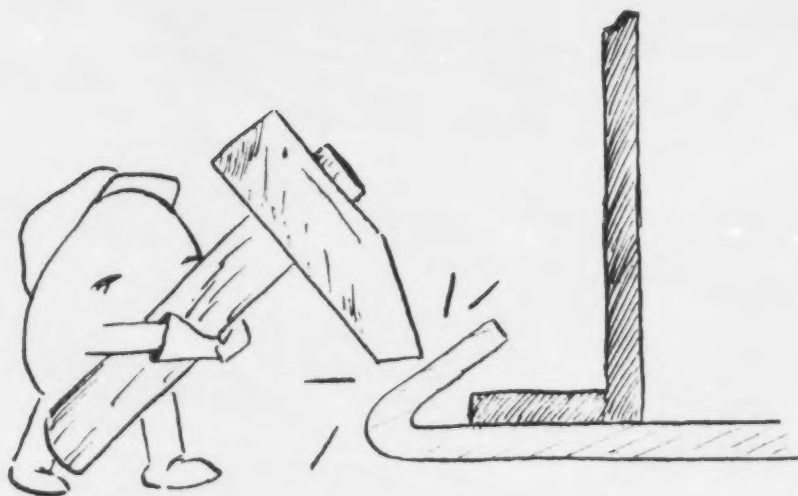
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

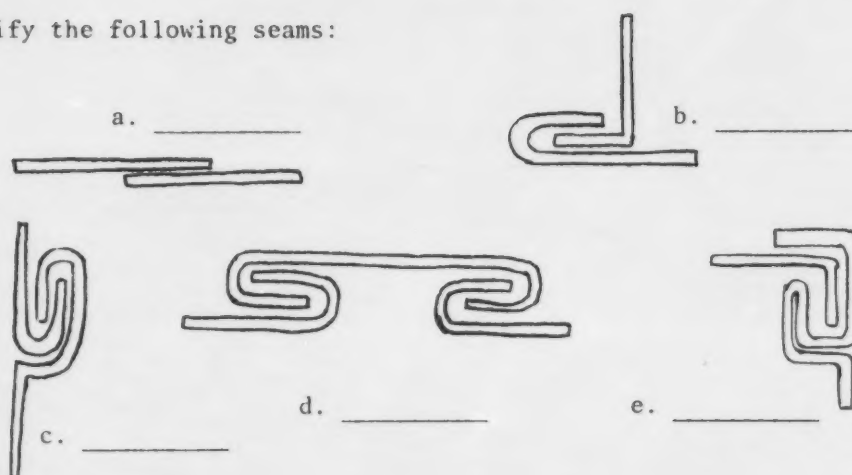
Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Draw the steps in making a single seam on a straight-edged container.

2. Identify the following seams:



3. MULTIPLE CHOICE. When putting a bottom on a can, the strongest joint would be (a) double seam (b) outside lap seam (c) lap bottom seam (d) wired edge.

4. TRUE or FALSE. The cap strip seam is used for putting lids on metal boxes.

STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ SHEET METAL WORKER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Various Sheet Metal Seams					
Seeing What Various Seams Are Used For					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Form Sheet Metal with a Rotary Machine

LEARNING OBJECTIVES:

1. Name the Parts of a Rotary Machine

Activities:

- a. Read page 195 in Technical Metals.
- b. Watch a demonstration on the parts of a rotary machine.
- c. On the worksheet, name the major parts of a rotary machine.
- d. Watch the movie: Forming on Rotary Machines.

Materials:

Rotary machine and rolls

2. Make a Wired Edge with the Rotary Machine

Activities:

- a. Read pages 194 to 195 in Technical Metals.
- b. Watch a demonstration on how to make a wired edge with the rotary machine.
- c. Practice making a wired edge using scrap wire and sheet metal.

Materials:

Rotary machine and rolls, scrap wire, scrap sheet metal, setting down hammer

3. Make a Flange with the Rotary Machine

Activities:

- a. Read pages 196 to 197 in Technical Metals.

- b. Watch a demonstration on how to make a flange with the rotary machine.
- c. Practice making a flange using scrap sheet metal cut in the shape of a disc.

Materials:

Rotary machine and rolls, snips, scrap sheet metal

EVALUATION:

1. On the cylinder prepared in Lesson 7, join the two edges together in a cap-strip seam prepared with the rotary machine. Next, form a wired edge on the top of the cylinder using the procedure you outlined. The final step is to cut a sheet metal bottom and attach it to the cylinder using a single seam made on the rotary machine. NOTE: A different bottom seam may be suggested by your instructor.

Submit the completed project to your instructor for evaluation.

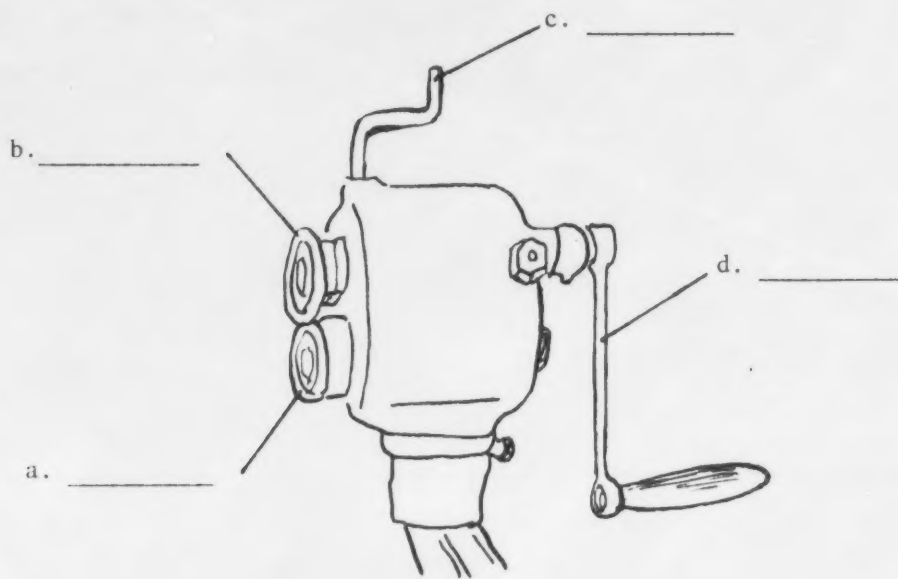
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Identify the parts of the rotary machine:



2. Draw a picture showing what the turning rolls of a rotary machine looks like.

3. Name five operations which can be done on a rotary machine.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Rotary Machine Is Used For					
Seeing How to Make Seams and Hems With the Rotary Machine					
Forming a Wired Edge					
Making a Single Seam on a Cylinder					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Sheet Metal Worker

OCCUPATIONAL COMPETENCY: Fasten Sheet Metal

LEARNING OBJECTIVES:

1. Describe Sheet Metal Screws

Activities:

- a. Read pages 200 to 201 in Technical Metals.
- b. Watch a demonstration on identifying and using sheet metal screws.
- c. Look at an assortment of sheet metal screws and identify the head and point style of each.
- d. Practice using sheet metal screws by joining two pieces of scrap metal together.

Materials:

Scrap sheet metal, hand drill, drill bits, hammer, center punch, screwdriver, assortment of sheet metal screws

2. Apply Pop Rivets

Activities:

- a. Read page 67 in Metalworking/Little.
- b. Watch a demonstration on how to apply pop rivets.
- c. On the worksheet, tell why some pop rivets have enamel paint on their heads and others do not.
- d. Practice using pop rivets by joining two pieces of scrap sheet metal together.

Materials:

Scrap sheet metal, hand drill, drill bits, pop rivets, pop rivet gun

3. Solder Sheet Metal

Activities:

- a. Read pages 202 to 209 in Technical Metals.
- b. Watch a demonstration on soldering sheet metal.
- c. Practice soldering sheet metal by joining two pieces of scrap metal.
- d. Watch the movie: Hand Soldering.

Materials:

Scrap sheet metal, soldering iron, solder, flux, abrasive paper

EVALUATION:

1. Using the box formed in Lesson 6, fasten the sides together by:
 - a. soft soldering two sides
 - b. pop-rivetting one side
 - c. fastening one side with sheet metal screws

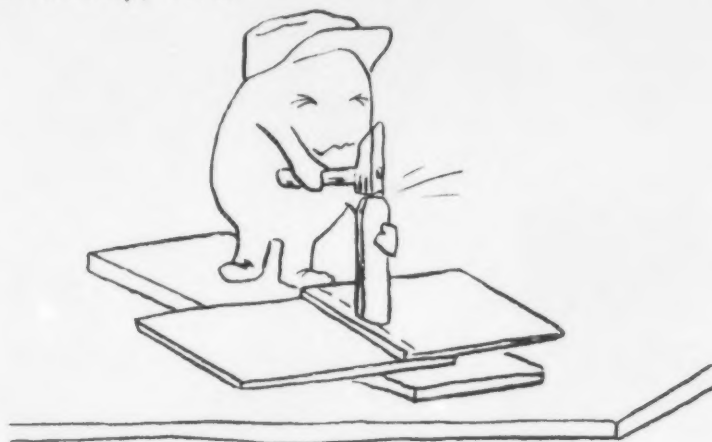
Submit the finished box to your instructor for evaluation.

2. Complete the worksheet. Submit the completed worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

Little, Richard and Sherry. Metalworking. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

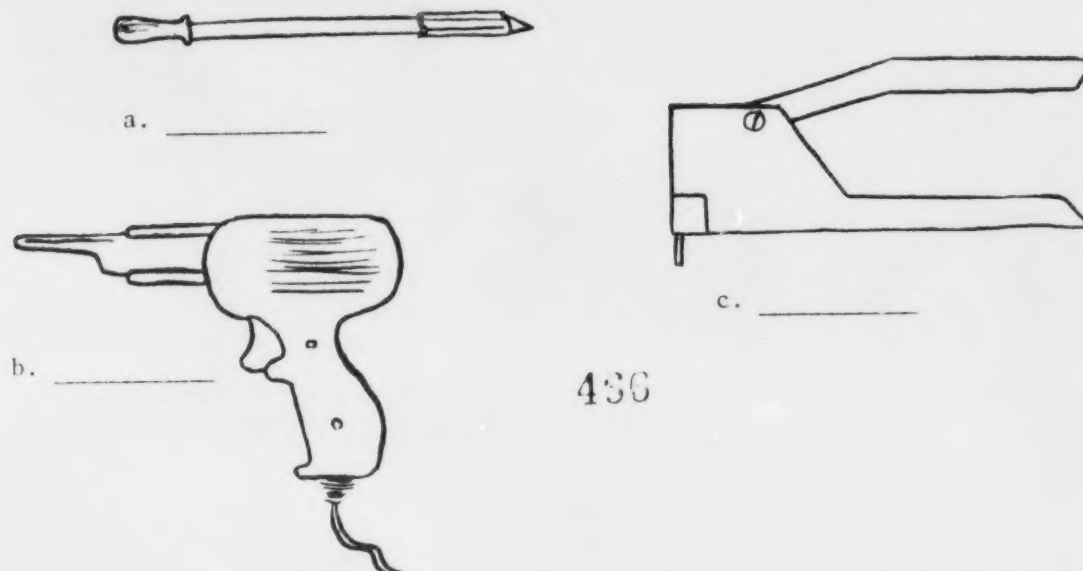
1. Why do some pop rivets have enamel paint on their heads?

2. Identify these screw head styles:



3. What is the difference between thread cutting and thread forming sheet metal screws?

4. Identify the following:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT SHEET METAL WORKER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How to Fasten Sheet Metal Joints Together					
Soft-Soldering Sheet Metal					
Pop-Rivetting Sheet Metal					
Fastening Sheet Metal Joints With Screws					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

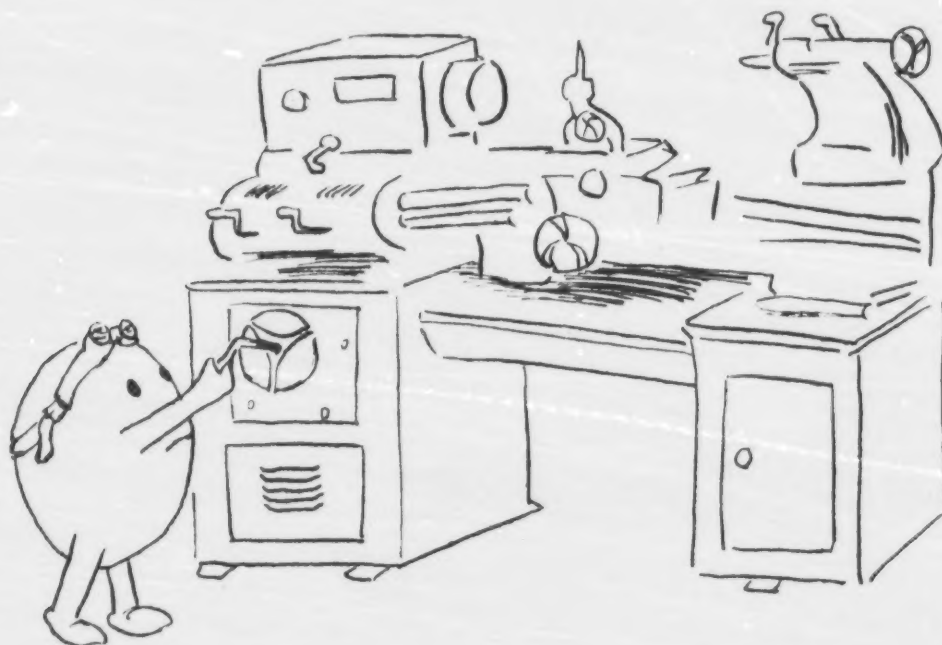
UNIT OF STUDY: Machinist

DOT OCCUPATIONAL CATEGORY: Machine Trades

DOT OCCUPATIONAL DIVISION: Metal Machining

DOT OCCUPATIONAL GROUP: Machinists and Related Occupations

OCCUPATIONAL OVERVIEW: The machinist sets up and operates machine tools, fits and assembles parts to make or repair tools, mechanisms or machines and applies knowledge of mechanics, shop mathematics, metal properties and blueprint reading. Verifies conformance of workpiece to specifications with precision measuring tools and procedures. Operates machines such as a lathe, milling machine grinder or planer.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

600.280-022	Machinist
600.280-010	Instrument Maker
600.280-042	Maintenance Machinist
600.280-050	Patternmaker, Metal
600.260-018	Model Maker, Firearms
600.380-018	Machine Set-Up Operator

LESSON 1

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Use Precision Measurement Tools

LEARNING OBJECTIVES:

1. Read a Steel Rule

Activities:

- a. Read pages 14 to 15 in Metalworking/Boyd.
- b. Watch a demonstration on how to use a steel rule.
- c. On the worksheet, name the divisions on a steel rule.
- d. Identify some small objects in the classroom and measure them as accurately as you can.
- e. Watch the movie: Steel Rule.

Materials:

Steel rule, classroom objects

2. Use Inside and Outside Calipers

Activities:

- a. Read pages 79 to 80 in Metalworking/Boyd.
- b. Watch a demonstration on how to use an inside and an outside caliper.
- c. On the worksheet, tell how a caliper setting is measured.
- d. Identify some small objects in the classroom and measure them as accurately as you can with the inside and outside calipers.

Materials:

Inside calipers, outside calipers, classroom objects, steel rule

3. Measure With a Micrometer

Activities:

- a. Read pages 80 to 82 in Metalworking/Boyd.
- b. Watch a demonstration on how to use and read a micrometer.
- c. Explain how to read the sleeve and thimble of the micrometer.
- d. Measure the thickness of this page, human hair, and a coin.
- e. Watch the movie: The Micrometer.

Materials:

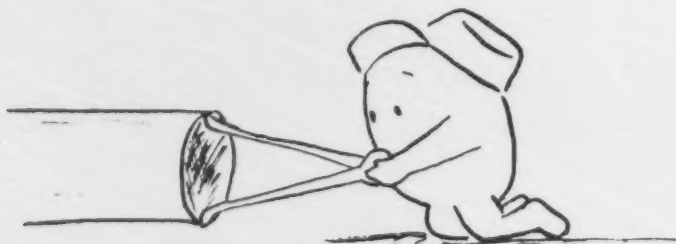
Micrometer, hair, coin, pencil and paper

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

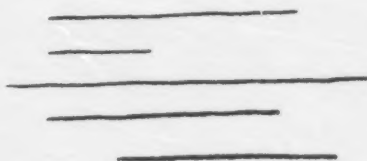
Boyd, T. Gardner. Metalworking. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1968.



WORKSHEET

1. Name the divisions on a steel rule.

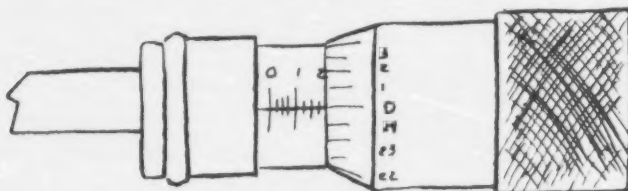
2. With the steel rule, measure these lines and name the length in the space provided.



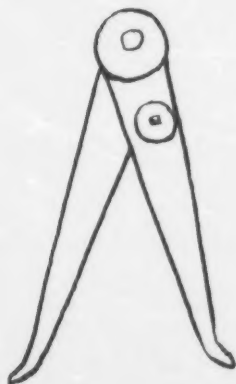
- a. _____
 b. _____
 c. _____
 d. _____
 e. _____

3. How is a caliper setting measured?

4. Read the following micrometer setting:

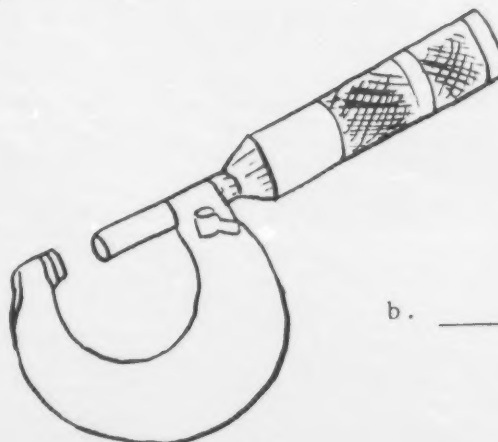


5. Identify the following tools:



a. _____

471



b. _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Using a Steel Rule to Measure Things					
Measuring with Calipers					
Measuring Things Very Precisely with a Micrometer					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Cut Threads with Taps and Dies

LEARNING OBJECTIVES:

1. Discuss Threads and Thread Types

Activities:

- a. Read page 40 in Metalworking/Boyd.
- b. Read pages 82 to 84 in Technical Metals.
- c. Watch a demonstration on the various types of threads.
- d. On the worksheet, tell where various thread types might be used.

Materials:

None

2. Cut Internal Threads with a Tap

Activities:

- a. Read pages 41 to 42 in Metalworking/Boyd.
- b. Watch a demonstration on how to cut internal threads with a tap.
- c. On the worksheet, explain the use of the three kinds of taps.
- d. Practice cutting internal threads using scrap metal.
- e. Watch the movie: Cutting Threads with Taps and Dies.

Materials:

Set of taps, electric hand drill, drill bits, hammer, center punch, cutting oil, combination square, vise

3. Cut External Threads with a Die

Activities:

- a. Read pages 42 to 43 in Metalworking/Boyd.
- b. Watch a demonstration on how to cut external threads with a die.
- c. On the worksheet, tell why the end of the stock must be ground to a taper in order to cut threads with a die.
- d. Practice cutting external threads with a die using scrap rod stock.

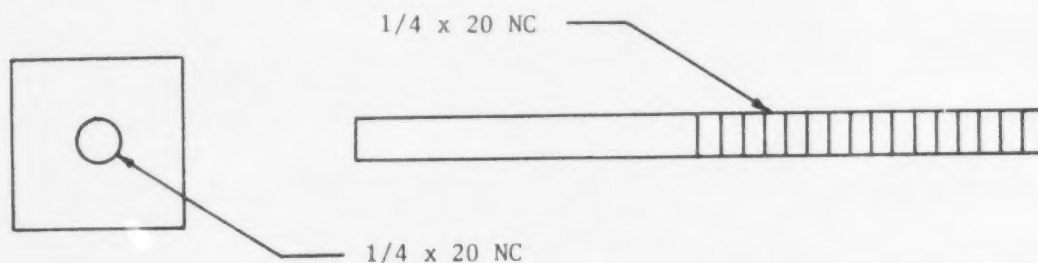
Materials:

Scrap rod stock, set of dies, file, vise, screw driver

EVALUATION:

1. Get a 1" square piece of 3/8" thick steel plate and a 4" long piece of 1/4" diameter drill rod from your instructor. Through the middle of the steel plate, cut a threaded hole of 1/4"-20 N.C. with a tap. Using a 1/4"-20 N.C. die, cut threads on the drill rod 2" long.

Assemble the two parts and submit them to your instructor for evaluation.



2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Boyd, T. Gardner. Metalworking. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1968.
 Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

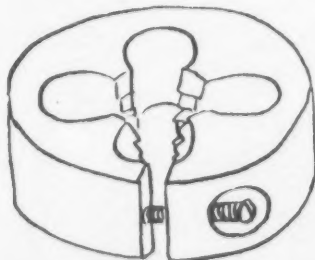
1. Draw the different thread forms and explain what they are used for.

2. Draw the different kinds of taps and explain what they are used for.

3. TRUE or FALSE When cutting internal threads with a $\frac{1}{4}$ -20NC tap, one must first drill a hole with a $\frac{1}{4}$ " drill bit.

4. Why must the end of the stock be tapered when cutting threads with a die?

5. Identify this tool:



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Different Types of Threads					
Finding Out How Threads are Made					
Making Internal Threads with a Tap					
Making External Threads with a Die					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Describe the Metal Lathe

LEARNING OBJECTIVES:

1. Tell How a Metal Lathe Works

Activities:

- a. Read page 82 in Metalworking/Boyd.
- b. Watch a demonstration on the use of a metal lathe.
- c. On the worksheet, name some objects made on a metal lathe.

Materials:

None

2. Discuss the Main Parts of the Lathe

Activities:

- a. Read pages 335 to 338 in Technical Metals.
- b. Watch a demonstration on the parts of the metal lathe.
- c. Look at the metal lathe in the shop and identify the major parts.
- d. Watch the movie: The Lathe.

Materials:

Metal lathe

3. Discuss the Main Cutting Tools for the Metal Lathe

Activities:

- a. Read pages 338 to 341 in Technical Metals.
- b. Watch a demonstration on the cutting tools for the metal lathe.
- c. Look at an assortment of cutting tools, identify the types and tell what they are used for.

Materials:

An assortment of cutting tools

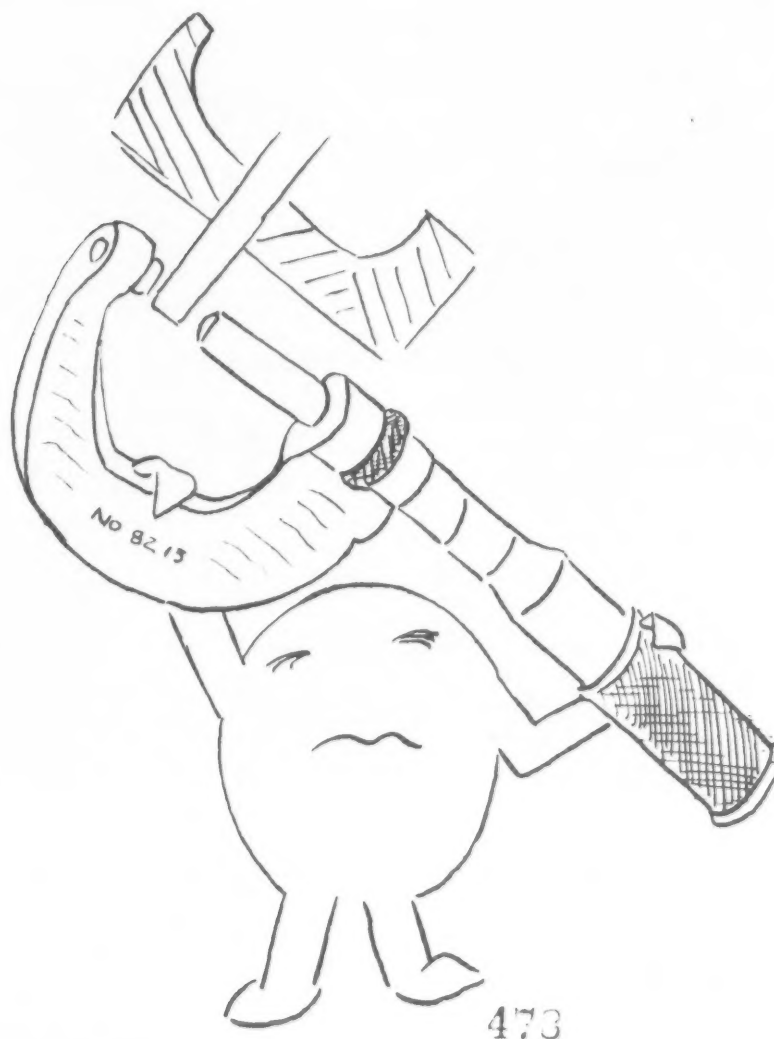
EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Boyd, T. Gardner. Metalworking. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1968.

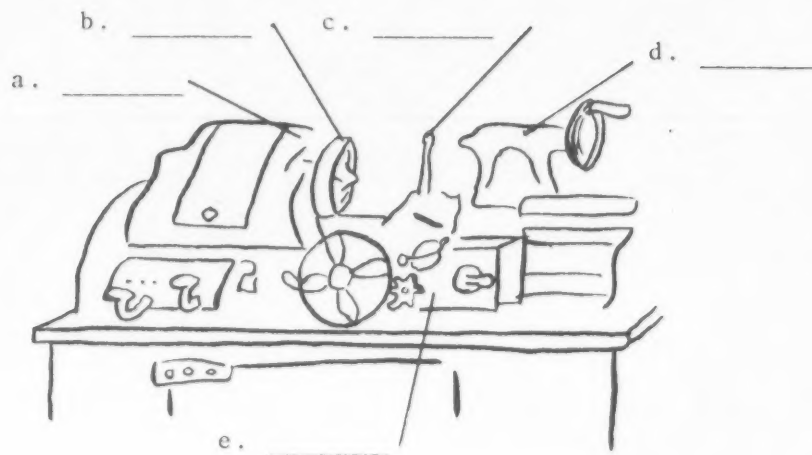
Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Name some objects made on a lathe.

2. Identify the parts of the lathe:



3. Draw a picture of a right rough cutting bit for the metal lathe.

4. Explain how the size of a lathe is designated.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing What a Metal Lathe Does					
Learning About the Parts of the Metal Lathe					
Finding Out What the Various Lathe Cutting Bits Do					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Face and Centerdrill Stock on the Metal Lathe

LEARNING OBJECTIVES:

1. Outline the Steps in Centerdrilling Stock

Activities:

- a. Read pages 343 to 344 in Technical Metals.
- b. Watch a demonstration on how to centerdrill stock mounted on a metal lathe.
- c. On the worksheet, tell why round stock is usually held in a three jaw universal chuck when centerdrilling.
- d. Practice setting up the lathe for centerdrilling.

Materials:

Metal lathe, round stock, center drill, three jaw chuck, allen wrenches, jacobs chuck

2. Outline the Steps in Facing Stock Between Centers

Activities:

- a. Read page 344 in Technical Metals.
- b. Watch a demonstration on how to face stock held between centers.
- c. On the worksheet, tell why you should use a half center in the tail stock for this operation.

Materials:

None

3. Outline the Steps in Facing Stock Held by a Three Jaw Universal Chuck

Activities:

- a. Read pages 349 to 350 in Technical Metals.

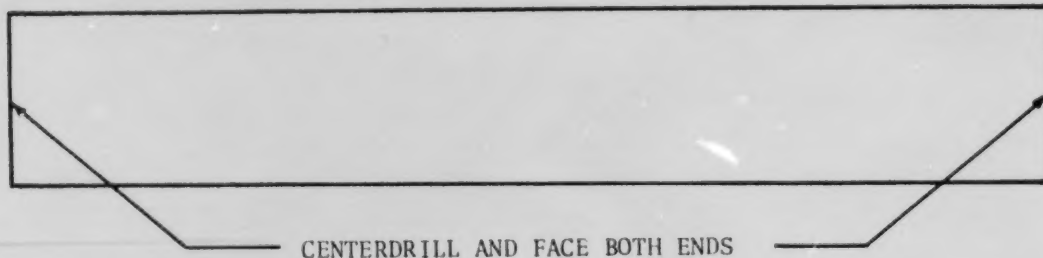
- b. Watch a demonstration on how to face stock held by a three jaw universal chuck.
- c. On the worksheet, explain why the facing tool must be exactly on center for this operation.
- d. Practice setting up the lathe to face the stock held by a three jaw chuck.
- e. Watch the movie: Facing on the Lathe.

Materials:

Metal lathe, three jaw chuck, round stock, facing tool, wrenches

EVALUATION:

1. Get a 6" long piece of 1" diameter bar steel from your instructor. Centerdrill and face each end. Submit the machined piece to your instructor for evaluation.



2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

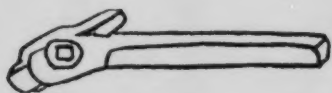
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Why is round stock usually held in a chuck when it is being centerdrilled?
2. When facing stock between centers, why should you use a half center in the tail stock?
3. Why must the cutting tool be exactly on center when facing stock on the lathe?

4. Identify these tools:



a. _____



b. _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning Why Things are Centerdrilled and Faced on the Lathe					
Seeing How Centerdrilling and Facing are Done					
Using a Three Jaw Universal Chuck					
Facing and Centerdrilling Stock on the Lathe					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Turn Stock Between Centers

LEARNING OBJECTIVES:

1. Describe How to Mount the Tool in the Tool Post

Activities:

- a. Read page 112 in Metalworking/Little.
- b. Read page 84 in Metalworking/Boyd.
- c. Watch a demonstration on mounting the cutting tool in the tool post of the metal lathe.
- d. Practice mounting the cutting tool in the tool post so that it is on center.

Materials:

Metal lathe, cutting tool, wrenches

2. Outline How to Turn Stock Between Centers

Activities:

- a. Read pages 344 to 345 in Technical Metals.
- b. Watch a demonstration on turning stock to size between centers.
- c. On the worksheet, tell the difference between rough turning and finish turning.
- d. Watch the movie: Rough Turning Between Centers.

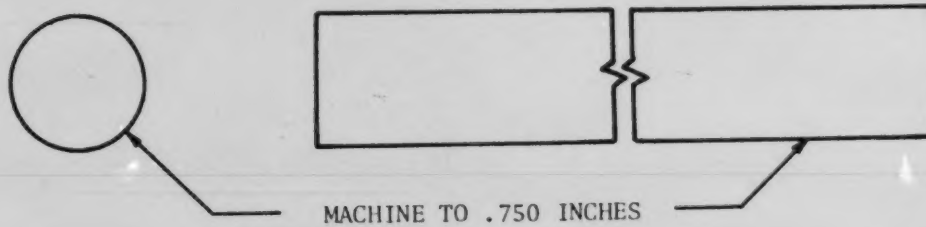
Materials:

- None

EVALUATION:

1. Mount the machined stock from Lesson 4 in the metal lathe. Set it up between centers with a bent tail dog. Using an appropriate cutting bit, machine the piece to a finished diameter of .750 inch.

Submit the finished piece to your instructor for evaluation.



2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Boyd, T. Gardner. Metalworking. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1968.

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

Little, Richard and Sherry. Metalworking. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. What is rough turning? finish turning?

2. Draw and describe the two types of chucks.

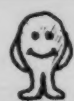
3. TRUE or FALSE Setting the cutting tool for a cut of $\frac{5}{1000}$ inch will actually result in removing $\frac{10}{1000}$ inch from the stock.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Positioning a Cutting Tool on the Lathe					
Machining Metal to a Finished Size					
Using a Bent-Tail Dog to Turn the Stock Between Centers					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Cut Threads on the Metal Lathe

LEARNING OBJECTIVES:

1. Tell How to Adjust the Gear Box

Activities:

- a. Read page 338 in Technical Metals.
- b. Watch a demonstration on how to adjust the feed and thread cutting gear box.
- c. Practice changing gears by selecting a feed rate and then making the necessary adjustments.

Materials:

None

2. Outline the Steps in Cutting Threads on the Metal Lathe

Activities:

- a. Read page 351 in Technical Metals.
- b. Watch a demonstration on how to cut threads on the metal lathe.
- c. Practice setting up the lathe for cutting threads.
- d. Watch the movie: Cutting an External National Fine Thread.

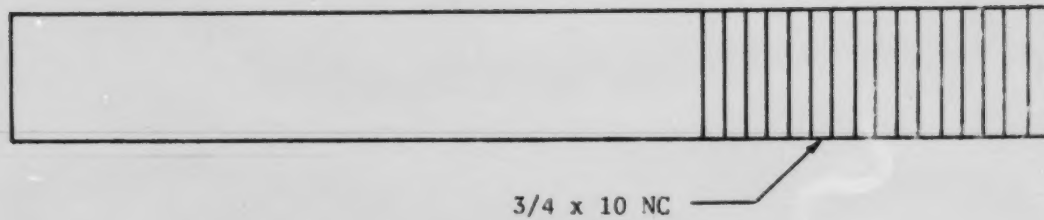
Materials:

Metal lathe, thread cutting bit, wrenches

EVALUATION:

1. Mount the workpiece from Lesson 5 in the lathe. Cut a $3/4 \times 10$ N.C. thread 2" in length measured from the end of the piece.

Submit the finished piece to your instructor for evaluation.



2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Adjusting the Gear Box on the Lathe					
Cutting Threads on the Lathe					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Drill Stock in the Metal Lathe

LEARNING OBJECTIVES:

1. Tell How Both Types of Drill Shanks Are Mounted on the Lathe

Activities:

- a. Read page 350 to 351 in Technical Metals.
- b. Watch a demonstration on how to mount drills on the metal lathe.
- c. Mount a taper shank drill bit and a straight shank drill bit on the tail stock for practice.

Materials:

Metal lathe, jacob's chuck, straight shank drill bit, taper shank drill bit

2. Outline How to Drill Stock on the Metal Lathe

Activities:

- a. Read page 350 to 351 in Technical Metals.
- b. Watch a demonstration on drilling stock mounted on the metal lathe.
- c. On the worksheet, tell why the stock should be centerdrilled before it is drilled on the lathe.
- d. Watch the movie: Drilling, Boring and Reaming Work Held in a Chuck.

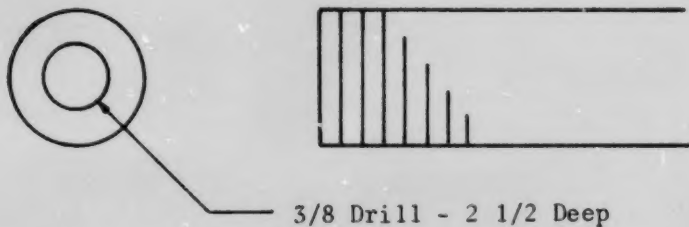
Materials:

None

EVALUATION:

1. Mount the machined piece from Lesson 6 on the metal lathe. From the threaded end, drill a 3/8" diameter hole to a depth of 2 1/2 inches.

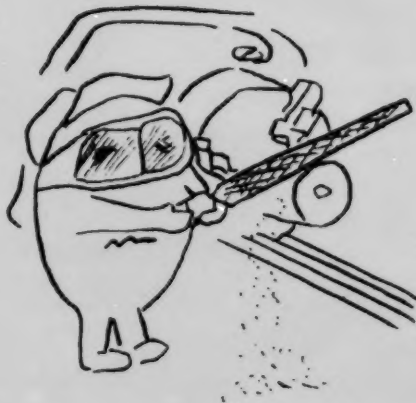
Submit the drilled piece to your instructor for evaluation.



2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

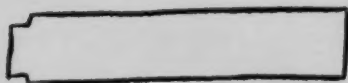
Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



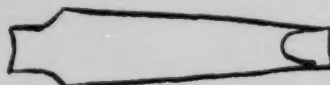
WORKSHEET

1. Why must the workpiece be centerdrilled before it is drilled on the lathe?

2. Identify the shanks on these drill bits:



a. _____



b. _____

3. What is the purpose of cutting oil in the drilling operation?

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER

MANUFACTURING

UNIT

MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Mounting Drill Bits on the Lathe					
Drilling Metal to a Specific Size on the Lathe					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Discuss the Milling Machine

LEARNING OBJECTIVES:

1. Name the Two Main Types of Milling Machines

Activities:

- a. Read pages 90 to 91 in Metalworking/Boyd.
- b. Watch a demonstration on the different types of milling machines.
- c. On the worksheet, tell how a milling machine works.

Materials:

None

2. Identify the Parts of the Milling Machine

Activities:

- a. Read page 91 in Metalworking/Boyd.
- b. Watch a demonstration on the identification of the parts of the milling machine.
- c. Look at a milling machine in the shop and identify the major parts.
- d. Watch the movie: The Milling Machine.

Materials:

Milling machine

3. Discuss the Operation of the Milling Machine

Activities:

- a. Read pages 90 to 91 in Metalworking/Boyd.
- b. Read pages 360 to 368 in Technical Metals.

- c. Watch a demonstration on the operation of a milling machine.
- d. Practice setting up a milling machine to make a simple cut.

Materials:

Milling machine, plain flanged vise, plain milling cutter

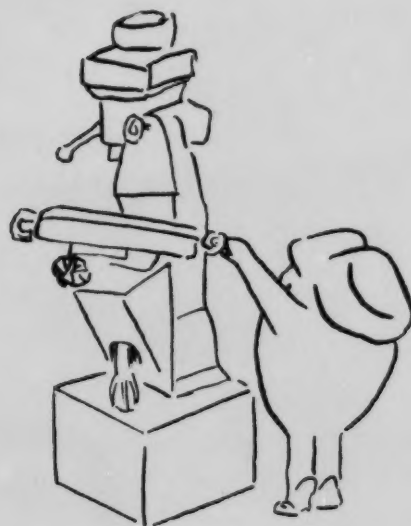
EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Boyd, T. Gardner. Metalworking. South Holland, Illinois, Goodheart-Willcox Co., Inc., 1968.

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. How does a milling machine work?

2. Identify these milling machines:



a. _____



b. _____

3. Name three types of milling machine cutters.

4. Name some of the operations which can be done on a vertical milling machine.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing What Milling Machines Do					
Learning About the Parts of the Various Milling Machines					
Watching a Milling Machine Operate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Use the Drill Press

LEARNING OBJECTIVES:

1. Identify the Classes and Sizes of Drill Bits

Activities:

- a. Read pages 370 to 371 in Technical Metals.
- b. Watch a demonstration on the different sizes and classes of drill bits.
- c. From an assortment of drill bits, select several and identify their size by looking at the size stamped on them and by using a drill gage.

Materials:

An assortment of drill bits, drill gages

2. Name the Parts of the Drill Press.

Activities:

- a. Read page 21 in Metalworking/Little.
- b. Watch a demonstration on the identification of the parts of a drill press.
- c. Look at the drill press in the shop and identify the major parts.
- d. Watch the movie: The Drill Press.

Materials:

Drill press

3. Outline the Drilling Operation of the Drill Press

Activities:

- a. Read pages 376 to 377 in Technical Metals.

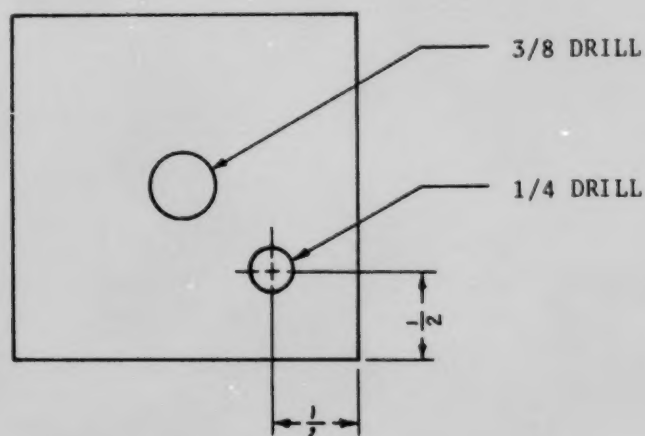
- b. Watch a demonstration on how to use the drill press to drill a hole.
- c. On the worksheet, tell why the drill press table has a large hole in the middle of it.
- d. Practice using the drill press by drilling a 1/8" diameter hole through scrap metal plate.

Materials:

Drill press, chuck key, scrap metal plate, 1/8" drill bit, center punch, hammer, wood block

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Get a 2" x 2" piece of 1/2" thick steel from your teacher. Lay-out and drill a 3/8" diameter hole through the center of the steel plate. Next, drill a 1/4" diameter hole as indicated in the following drawing:



3. Complete the attitude sheet.

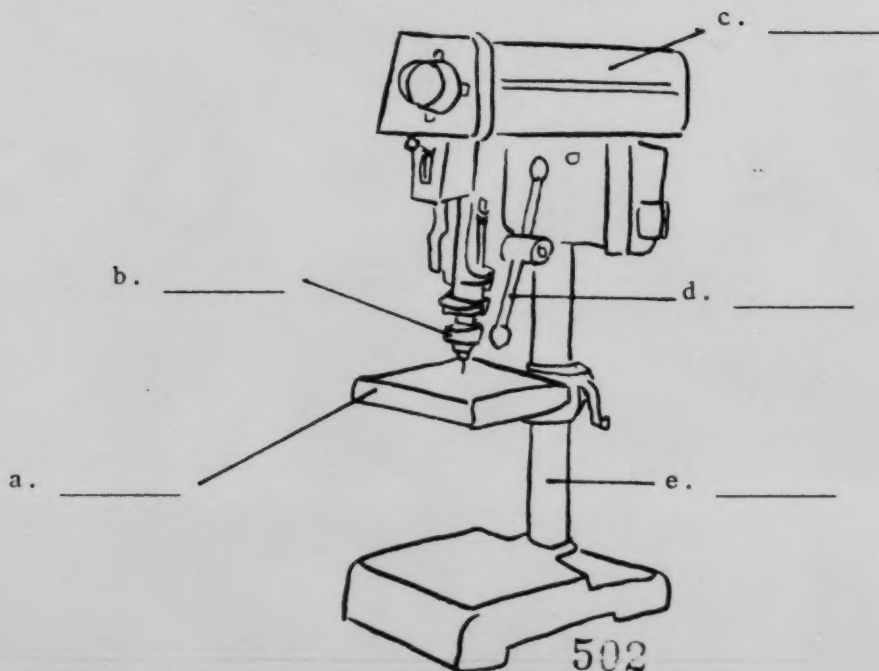
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

Little, Richard and Sherry. Metalworking. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Why does the drill press table have a large hole in the middle of it?
2. Drill sizes are designated in four ways. Name them.
3. What is a drill gage?
4. TRUE or FALSE A number 2 drill bit makes a larger hole than a $\frac{3}{16}$ drill bit.
5. Name the parts of a drill press:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Sizes of Drill Bits					
Seeing What a Drill Press Does					
Drilling Stock to a Specific Size on the Drill Press					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Machinist

OCCUPATIONAL COMPETENCY: Use the Bench Grinder

LEARNING OBJECTIVES:

1. Name the Parts of the Bench Grinder

Activities:

- a. Read page 30 in Metalworking/Little.
- b. Watch a demonstration on identifying the parts of the bench grinder.
- c. Look at the bench grinder in the shop and name the major parts.

Materials:

Bench grinder

2. Outline the Operation of the Bench Grinder

Activities:

- a. Read pages 30 to 31 in Metalworking/Little.
- b. Watch a demonstration on using the bench grinder.
- c. Practice using the bench grinder by getting a piece of scrap steel plate and grinding one edge straight and smooth.
- d. Watch the movie: Grinder and Buffer.

Materials:

Bench grinder, coarse wheel, fine wheel, scrap steel plate

EVALUATION:

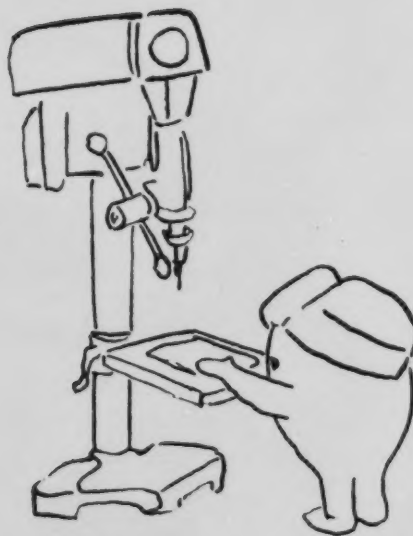
1. Get a tool which needs to be sharpened from your instructor or bring one from home. Determine how it is to be ground on the bench grinder, then sharpen it.

Submit the sharpened tool to your instructor for evaluation.

2. Complete the attitude sheet.

RESOURCES:

Little, Richard and Sherry. Metalworking. Chicago, Illinois,
American Technical Society, 1979.



STUDENT ATTITUDE SHEET

for _____

CLUSTER MANUFACTURING UNIT MACHINIST

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing What a Bench Grinder Does					
Learning About the Parts of the Grinder					
Using a Grinder to Sharpen a Tool					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

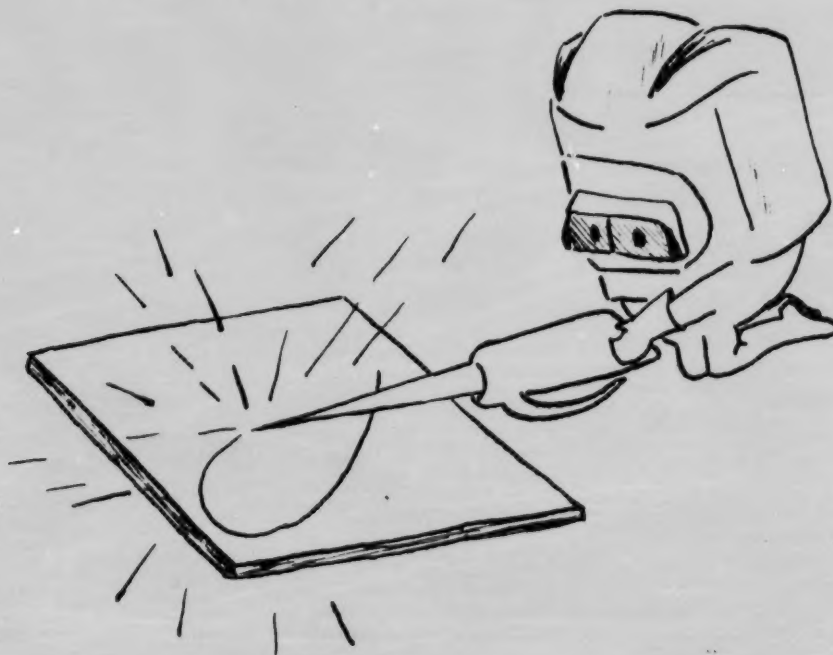
UNIT OF STUDY: Welder

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Welders, Cutters and Related Occupations

DOT OCCUPATIONAL GROUP: Arc Welders, Gas Welders, Others

OCCUPATIONAL OVERVIEW: The welder joins, surfaces, fabricates and repairs structures or parts made of metal. Sets up and operates welding and cutting equipment as specified by layout, blueprint, diagram or work order. Inspects weld for quality and compliance with specifications. May cut metal plates or shapes.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

810.382-010	Welding Machine Operator, Arc
810.384-014	Welder, Arc
811.684-014	Welder, Gas
812.682-010	Welding Machine Operator, Resistance
813.684-014	Solderer, Assembler
816.464-010	Torch Cutter
819.361-010	Welder-Fitter

LESSON 1

UNIT: Welder

OCCUPATIONAL COMPETENCY: Describe the Equipment for Oxyacetylene Welding

LEARNING OBJECTIVES:

1. Tell About the Gas Tanks

Activities:

- a. Read pages 266 to 267 in Technical Metals.
- b. Watch a demonstration on oxygen and acetylene welding tanks.
- c. Tell some safety rules about the use of gas welding equipment on the worksheet.
- d. Watch the movie: Oxyacetylene Welding - Equipment.

Materials:

None

2. Describe the Welding Torch

Activities:

- a. Read page 267 in Technical Metals.
- b. Watch a demonstration on the welding torch and its adjustment.
- c. Look at a welding torch and name the major parts.

Materials:

Welding torch and tip

3. Describe the Various Welding Torch Tips

Activities:

- a. Read page 267 in Technical Metals.
- b. Watch a demonstration on welding torch tips and their use.
- c. Remove a tip from a welding torch and replace it with another.

Materials:

Welding torch, tips

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

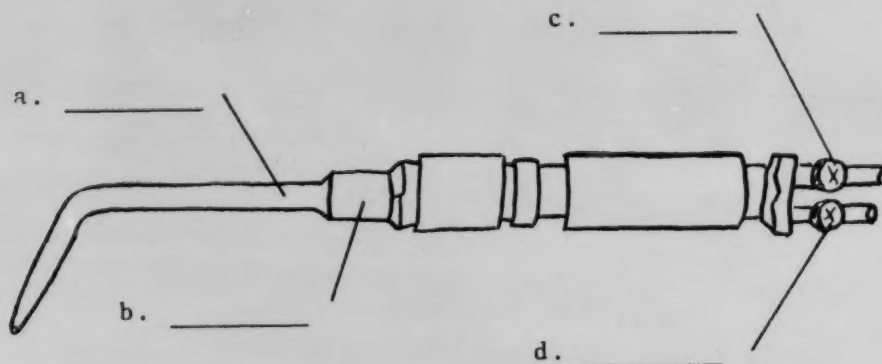
Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. Define Welding.
2. Tell some safety rules about the use of gas welding equipment.

3. Name the parts of the welding torch:



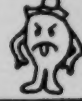
4. What safety devices are used to stop cylinders from exploding from intense pressure?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Gas Tanks					
Knowing About the Welding Torch					
Learning About Torch Tips					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Welder

OCCUPATIONAL COMPETENCY: Adjust Oxyacetylene Welding Equipment

LEARNING OBJECTIVES:

1. Adjust the Oxygen and Acetylene Regulators

Activities:

- a. Read pages 268 to 269 in Technical Metals.
- b. Watch a demonstration on how to adjust the oxygen and acetylene regulators.
- c. On the worksheet, tell why there are two gages on most regulators.
- d. Practice adjusting the gas regulators by setting both oxygen and acetylene to 5 psi.

Materials:

Gas tanks and regulators

2. Select a Welding Tip

Activities:

- a. Read page 269, Table 62-B, in Technical Metals.
- b. Watch a demonstration on how to select the correct size welding tip to do a certain job.
- c. Look at an assortment of welding tips and identify the number (size) of each.
- d. On the worksheet, tell what tip size a welder would select to weld $\frac{1}{4}$ " steel plate.

Materials:

Assortment of welding tips

3. Light the Torch

Activities:

- a. Read page 269 in Technical Metals.
- b. Watch a demonstration on how to light the torch.
- c. Practice lighting the torch until you can easily do it.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch

4. Shut Off the Torch

Activities:

- a. Read page 270 in Technical Metals.
- b. Watch a demonstration on how to shut off the torch.
- c. After you have lit the torch, practice going through the correct procedure to shut it off.

Materials:

Gas tanks and regulators, goggles, torch

EVALUATION:

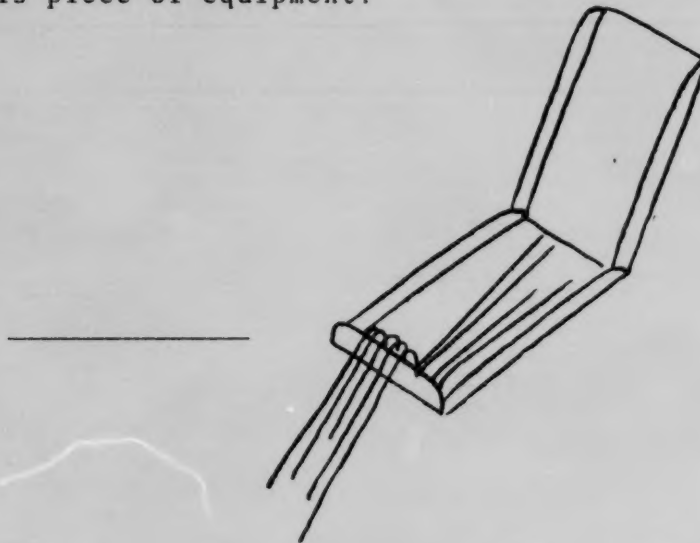
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Set-up the oxyacetylene equipment to weld $\frac{1}{4}$ inch steel and light the torch. Have your instructor check your work.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Why are there two gages on most regulators?
2. Multiple Choice. The tip size you would use to weld $\frac{1}{4}$ " steel plate is: (a) 2 (b) 3 (c) 5 (d) 7
3. Identify this piece of equipment:



4. TRUE or FALSE. A #7 welding tip is a bigger size than a #4 tip.
5. TRUE or FALSE. Always turn the oxygen on first when lighting the torch.
6. How is an oxygen hose different from an acetylene hose?
7. Why should the acetylene be shut off first?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Adjusting the Oxygen and Acetylene Regulators					
Selecting Torch Tip Sizes					
Lighting the Torch					
Shutting Off the Torch					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Welder

OCCUPATIONAL COMPETENCY: Draw a Bead With the Torch

LEARNING OBJECTIVES:

1. Describe Several Types of Welding Flames

Activities:

- a. Read pages 269 to 270 in Technical Metals.
- b. Watch a demonstration on how to adjust the torch to get different types of flames.
- c. On the worksheet, describe the four types of welding flames.
- d. Practice adjusting the torch until you can easily get any of the welding flames.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch

2. Run a Bead Without a Filler Rod

Activities:

- a. Read pages 270 to 271 in Technical Metals.
- b. Watch a demonstration on how to run a welding bead without a filler rod.
- c. Practice running a welding bead without a filler rod on scrap steel plate.
- d. Watch the movie: Oxyacetylene Welding: Torch Techniques.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch, scrap steel plate

3. Run a Bead With a Filler Rod

Activities:

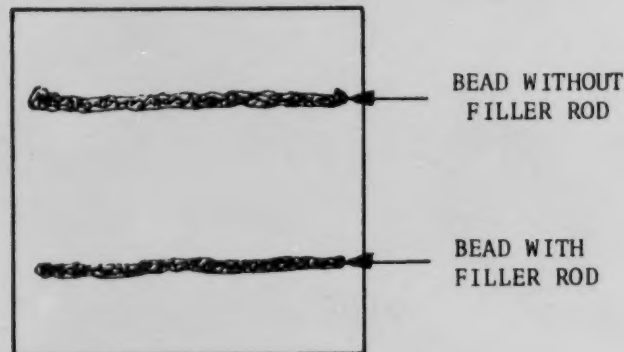
- a. Read page 271 in Technical Metals.
- b. Watch a demonstration on how to run a welding bead with a filler rod.
- c. Practice running a welding bead with a filler rod on scrap steel plate.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch, filler rod, scrap steel plate

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Get a 4" square piece of $\frac{1}{4}$ " steel plate from your instructor. Set up the oxyacetylene equipment as in Lesson 2. Across the plate, draw a welding bead without a filler rod. Draw another bead with a filler rod. Show your work to your instructor.



3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Describe the four types of welding flames.
2. How is a neutral flame produced?
3. What causes the flame to "pop"?
4. Draw a picture and tell how to draw a bead with a filler rod.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Adjust For Different Types of Flames					
Running a Bead Without a Filler Rod					
Running a Bead With a Filler Rod					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Welder

OCCUPATIONAL COMPETENCY: Weld With the Oxyacetylene Torch

LEARNING OBJECTIVES:

1. Weld a Lap Joint With a Filler Rod

Activities:

- a. Read pages 271 to 272 in Technical Metals.
- b. Watch a demonstration on how to weld a lap joint with a filler rod.
- c. Practice welding a lap joint with a filler rod on scrap steel plate.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch, filler rod, scrap steel plate

2. Weld a Lap Joint Without a Filler Rod

Activities:

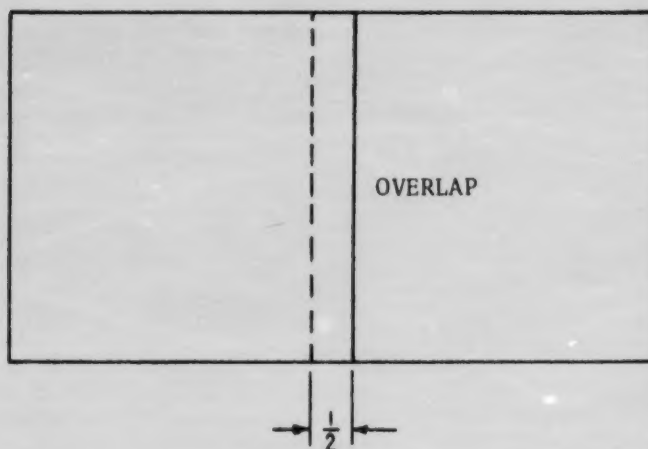
- a. Watch a demonstration on how to weld a lap joint without a filler rod.
- b. Practice welding a lap joint without a filler rod on scrap steel plate.

Materials:

Gas tanks and regulators, spark lighter, goggles, torch, scrap steel plate

EVALUATION:

1. Get a 4 inch square piece of $\frac{1}{4}$ " steel plate from your instructor. Lap this plate over the plate from Lesson 3 by $\frac{1}{2}$ inch. Set up the oxyacetylene equipment for welding $\frac{1}{4}$ inch steel. Tack the two ends of the steel plates together so they will not warp. Weld one side of the lap without a filler rod. Turn the plates over and weld the other lap joint with a filler rod. Submit the welded plates to your instructor for evaluation.



2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Welding a Lap Joint With a Filler Rod					
Welding a Lap Joint Without a Filler Rod					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Welder

OCCUPATIONAL COMPETENCY: Set Up Flame Cutting Equipment

LEARNING OBJECTIVES:

1. Describe the Cutting Torch

Activities:

- a. Read page 273 in Technical Metals.
- b. Watch a demonstration on the cutting torch and its use.
- c. Look at the cutting torch and name the major parts.
- d. Watch the movie: The Cutting Torch - Flamecutting.

Materials:

Cutting torch

2. Adjust Oxygen and Acetylene Pressure for Flame Cutting

Activities:

- a. Read page 273, Table 63-A, in Technical Metals.
- b. Watch a demonstration on how to adjust the oxygen and acetylene regulator pressures to flame cut.
- c. Practice adjusting the regulator pressures for flame cutting.

Materials:

Gas tanks and regulators

3. Select a Cutting Torch Tip

Activities:

- a. Read page 273, Table 63-A, in Technical Metals.

- b. Watch a demonstration on cutting torch tips and how to select one for a certain job.
- c. On the worksheet, tell what cutting torch tip a welder should select in order to flame cut $\frac{1}{4}$ " steel plate.

Materials:

None

EVALUATION:

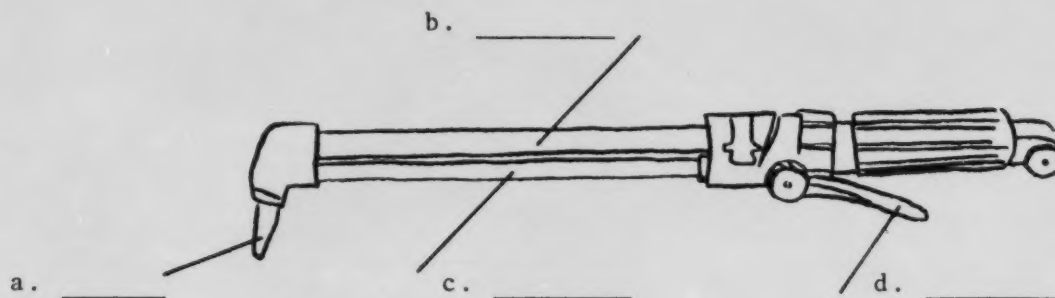
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Set up the flame cutting equipment to cut $\frac{1}{4}$ " steel plate. Have your instructor check your work.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Identify the major parts of the cutting torch:



2. What is flame cutting?

3. What cutting torch tip should you use to flame cut $\frac{1}{4}$ " steel plate?

4. TRUE or FALSE. A #3 cutting torch tip is smaller than a #2 tip.

5. TRUE or FALSE. In Flame cutting, oxygen and acetylene pressures are always the same.

6. TRUE or FALSE. The metal should be heated bright red before you attempt to cut it.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER _____

MANUFACTURING

UNIT _____

WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Cutting Torch					
Adjusting the Oxygen and Acetylene Pressure For Flame Cutting					
Selecting a Cutting Torch Tip					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Welder

OCCUPATIONAL COMPETENCY: Cut Metal with a Flame Cutting Torch

LEARNING OBJECTIVES:

1. Light the Flame Cutting Torch

Activities:

- a. Read page 274 in Technical Metals.
- b. Watch a demonstration on how to light the flame cutting torch.
- c. Practice lighting the flame cutting torch.

Materials:

Gas tanks and regulators, spark lighter, goggles, flame cutting torch

2. Cut Metal with a Torch

Activities:

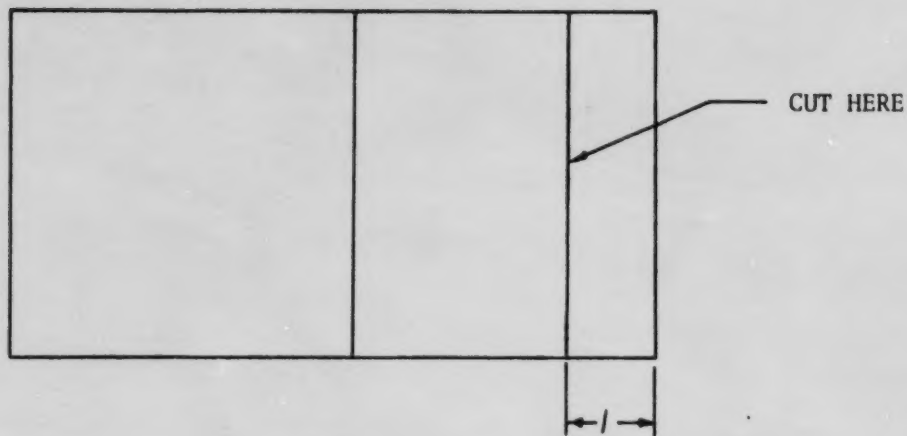
- a. Read page 27 in Technical Metals.
- b. Watch a demonstration on how to cut metal with a torch.
- c. Practice flame cutting scrap steel plate.
- d. Watch the movie: Flame - Cutting.

Materials:

Gas tanks and regulators, spark lighter, goggles, flame cutting torch, scrap steel plate

EVALUATION:

1. Set up the flame cutting equipment to cut $\frac{1}{4}$ " steel, as in Lesson 5. Using the welded material done in Lesson 4, cut off a 1" piece from the end of the steel plate. Have your instructor check your work.



2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ WELDER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Lighting a Flame Cutting Torch					
Cutting Metal With a Torch					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Welder

OCCUPATIONAL COMPETENCY: Describe the Equipment for Arc Welding

LEARNING OBJECTIVES:

1. Describe the Welding Machine

Activities:

- a. Read pages 274 to 275 in Technical Metals.
- b. Watch a demonstration on the welding machine and its parts.
- c. Look at an arc welding machine in the shop and name its major parts.

Materials:

None

2. Tell About the Electrode Holder

Activities:

- a. Read page 275 in Technical Metals.
- b. Watch a demonstration on the electrode holder and how to use it.
- c. Practice putting welding rods in the electrode holder.

Materials:

Electrode holder, welding rods

3. Discuss Other Welding Tools

Activities:

- a. Read page 276 in Technical Metals.
- b. Watch a demonstration on the use of other equipment for welding.
- c. On the worksheet, tell why the viewing filter in a welding hood is so dark.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

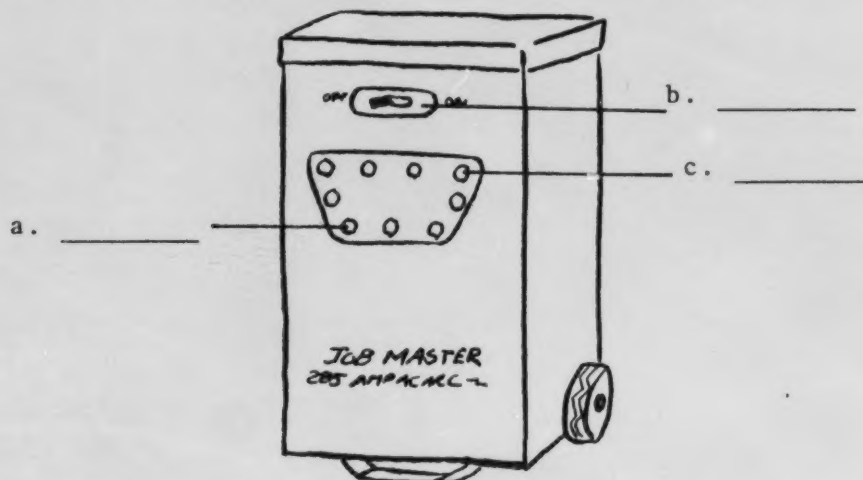
RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

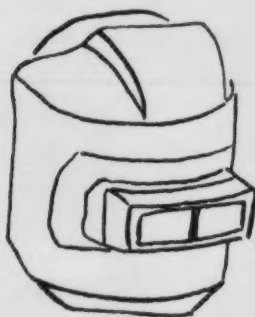
1. Identify the parts of the arc welding machine:



2. How does arc welding differ from gas welding?

3. Why is the viewing filter in a welding hood so dark?

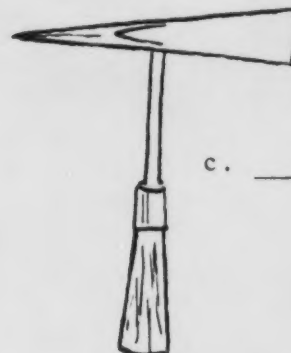
4. Identify this equipment:



a. _____



b. _____



c. _____

STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ WELDER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Arc Welding Machine					
Seeing How the Electrode Holder is Used					
Learning About the Other Welding Equipment					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Welder

OCCUPATIONAL COMPETENCY: Adjust Arc Welding Equipment

LEARNING OBJECTIVES:

1. Select a Welding Electrode

Activities:

- a. Read pages 276 to 277 in Technical Metals.
- b. Watch a demonstration on how to select a welding electrode to do a certain job.
- c. On the worksheet, tell what an E6012 welding electrode would be used for.
- d. Watch the movie: Arc Welding Electrode Selection.

Materials:

None

2. Adjust the Arc Welder

Activities:

- a. Read page 277, Table 64-A, in Technical Metals.
- b. Watch a demonstration on how to select current mode and amperage settings to weld a certain job.
- c. On the worksheet, tell what current mode and amperage setting would be used for an E6012 electrode which has a rod diameter of 1/8" (.125 inch).
- d. Practice setting current mode and amperage adjustments on the arc welding machine.

Materials:

Arc welding machine

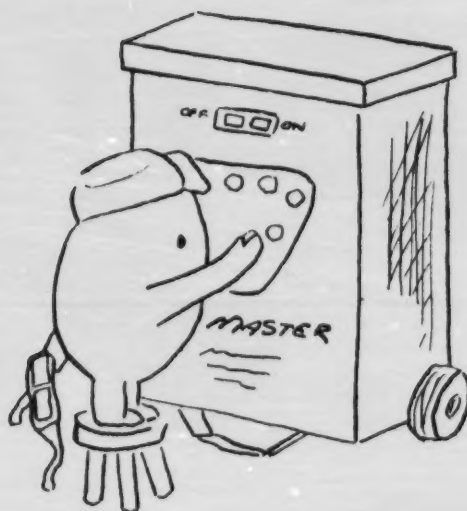
EVALUATION:

1. Set up the arc welding equipment and select a welding electrode to weld 1/4" steel plate with medium penetration. Have your instructor check your work.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



WORKSHEET

1. What is an E6012 welding electrode used for?
2. What current mode and amperage setting would be used for an E6012 electrode which has a rod diameter of 1/8" (.125 inch).
3. What does the coating on the electrode do?
4. What is polarity?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Selecting an Arc Welding Electrode					
Adjusting the Arc Welder					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Welder

OCCUPATIONAL COMPETENCY: Draw a Bead With the Arc Welder

LEARNING OBJECTIVES:

1. Describe the Two Ways to Strike an Arc

Activities:

- a. Read pages 277 to 278 in Technical Metals.
- b. Watch a demonstration on how to strike an arc with the electrode.
- c. Practice striking arcs in the two methods without any current from the welding machine.
- d. On scrap steel plate, practice striking arcs in the two methods with current from the welding machine.

Materials:

Arc welding machine, electrode, welding hood, protective clothing, scrap steel plate

2. Weld a Bead

Activities:

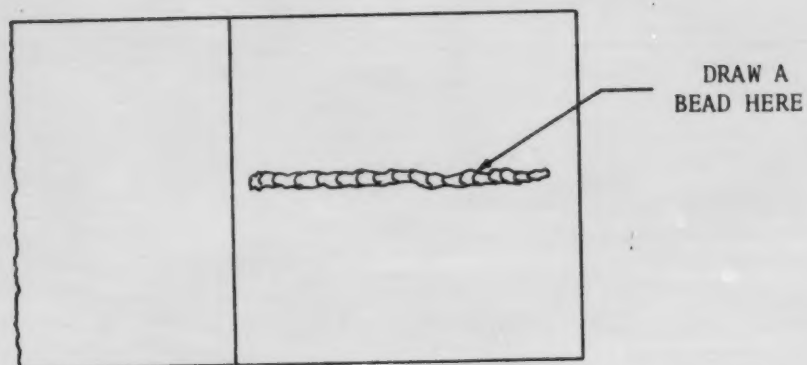
- a. Read pages 278 to 279 in Technical Metals.
- b. Watch a demonstration on how to weld a bead with the arc welding machine.
- c. Describe what a good weld bead looks like.
- d. Practice welding good beads on scrap steel plate.

Materials:

Arc welding machine, electrode, welding hood, protective clothing, scrap steel plate, chipping hammer, wire brush

EVALUATION:

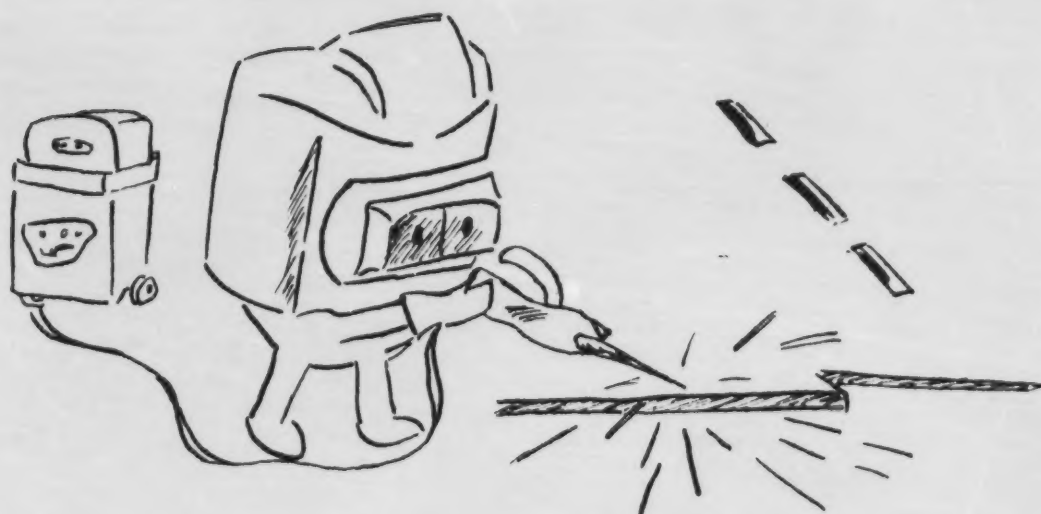
1. Set up the arc welding equipment to weld $\frac{1}{4}$ " steel plate as in Lesson 8. Using the large piece of steel plate cut in Lesson 6, weld a bead. Have your instructor check your work.



2. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How To Strike an Arc With the Electrode					
Welding a Bead With the Arc Welder					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Welder

OCCUPATIONAL COMPETENCY: Weld With the Arc Welder

LEARNING OBJECTIVES:

1. Demonstrate How to Weave the Electrode When Welding

Activities:

- a. Read page 279 in Technical Metals.
- b. Watch a demonstration on how to weave the electrode when welding.
- c. On the worksheet, describe four methods of weaving the electrode.
- d. On the worksheet, describe the "whip method" of electrode weaving.

Materials:

None

2. Weld a Groove Joint in a Flat Position

Activities:

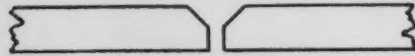
- a. Read page 279 in Technical Metals.
- b. Watch a demonstration on how to weld a groove joint in a flat position.
- c. Practice welding groove joints on scrap steel plate, work in a flat position and try the different weaving methods.

Materials:

Arc welding machine, electrodes, welding hood, protective clothing, scrap steel plate, chipping hammer, wire brush

EVALUATION:

1. Using the two pieces of steel cut in Lesson 6, grind a chamfer to form a groove joint between the plates. Set up the arc welding equipment to weld $\frac{1}{4}$ " steel plate as in Lesson 8 and 9. Using the whip method of electrode weaving, weld the two plates together in the flat position. Submit the work to your instructor for evaluation.



2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Johnson, Harold V. Technical Metals. Peoria, Illinois, Chas. A. Bennett Co., Inc., 1973.

WORKSHEET

1. Draw pictures and describe the four methods of weaving the electrode.

2. Describe the whip method of electrode movement.

3. Why is the correct welding speed important in obtaining a good weld?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WELDER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Weave the Electrode When Welding					
Welding a Groove Joint In the Flat Position					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

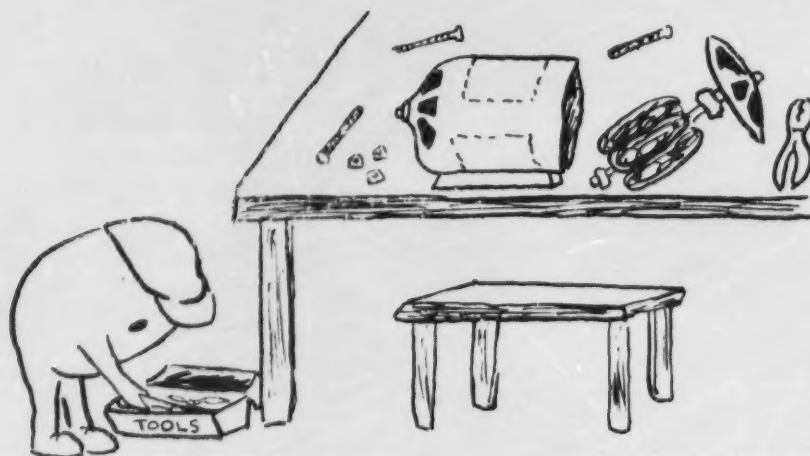
UNIT OF STUDY: Motor Repairer

DOT OCCUPATIONAL CATEGORY: Benchwork

DOT OCCUPATIONAL DIVISION: Assembly and Repair of Electrical Equipment

DOT OCCUPATIONAL GROUP: Assembly and Repair of Motors, Generators and Related Products

OCCUPATIONAL OVERVIEW: The motor repairer assembles and repairs electric motors, power generators, motor-generator sets, railway motors and control equipment. Assembles and repairs motors, generators and control equipment for gasoline-electric and oil-electric buses and trucks. Winds and assembles coils, magnets, armatures and related components. Conducts tests on electrical motors, generators and controls.



REPRESENTATIVE JOB TITLES AND DOT CODES:

721.131-010	Electric-Motor Repairing Supervisor
721.261-010	Electric-Motor Analyst
721.281-014	Electric-Motor Assembler and Tester
721.281-018	Electric-Motor Repairer
721.484-010	Electric-Motor Winder
724.381-014	Coil Winder, Repairer
820.361-014	Electric-Motor and Generator Assembler

LESSON 1

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Use the Power Law

LEARNING OBJECTIVES:

1. Define WATT

Activities:

- a. Read page 36 in Electricity and Electronics.
- b. Watch a demonstration on power and wattage rating.
- c. On the worksheet, define watt.

Materials:

None

2. Use the Power Law

Activities:

- a. Read page 36 in Electricity and Electronics.
- b. Watch a demonstration explaining the Power Law.
- c. On the worksheet, solve problems using the Power Law.

Materials:

None

3. Identify the Power Consumption of Common Devices

Activities:

- a. Read page 37 in Electricity and Electronics.
- b. Watch a demonstration on the power usage of common electrical devices.
- c. Look at an assortment of electrical devices and identify power ratings of each.

Materials:

Assortment of electrical devices

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Define watt.
2. State the Power Law.
3. Using the Power Law, solve the following problems.
 - a. How much current is used by a light rated at 12 volts and 20 watts?
 - b. How much power is used by a radio rated at 120 volts and .1 amperes of current?
 - c. What is the voltage rating of a toaster if it consumes 1200 watts of power and used 10 amperes of current?
4. TRUE or FALSE. A kilowatt is 100 watts.
5. TRUE or FALSE. It would be cheaper to listen to a 10 watt radio for one hour than to listen to 50 watt stereo tape player for fifteen minutes.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Watt Is					
Learning the Power Law					
Solving Problems With the Power Law					
Identifying Power Usage of Electric Devices					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Measure Voltage, Current and Resistance

LEARNING OBJECTIVES:

1. Identify the Three Scales of the VOM

Activities:

- a. Read page 59 in Electricity and Electronics.
- b. Watch a demonstration on the three scales of the VOM.
- c. Look at a VOM and identify the three scales.
- d. On the worksheet, tell what each scale of the VOM is used for.

Materials:

VOM

2. Measure Voltage, Current and Resistance

Activities:

- a. Read pages 59 to 61 in Electricity and Electronics.
- b. Watch a demonstration on how to measure voltage, current and resistance with a VOM.
- c. On a simple circuit, practice measuring voltage and current with the VOM.
- d. Practice measuring the ratings of some resistors with the VOM.
- e. Watch the movie: Circuit Testing with Meters and Multi-meters.
- f. Watch the movie: Use of Voltmeter.

Materials:

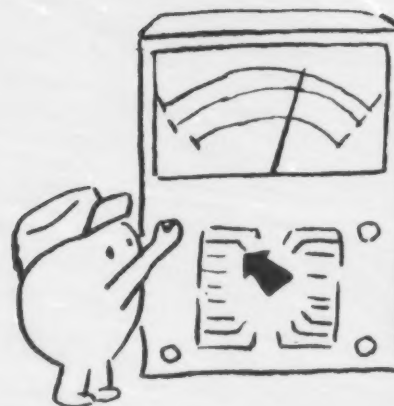
Simple prepared circuit, VOM, alligator wire leads, resistors

EVALUATION:

1. Get several resistors from your instructor and check resistance ratings with the VOM.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

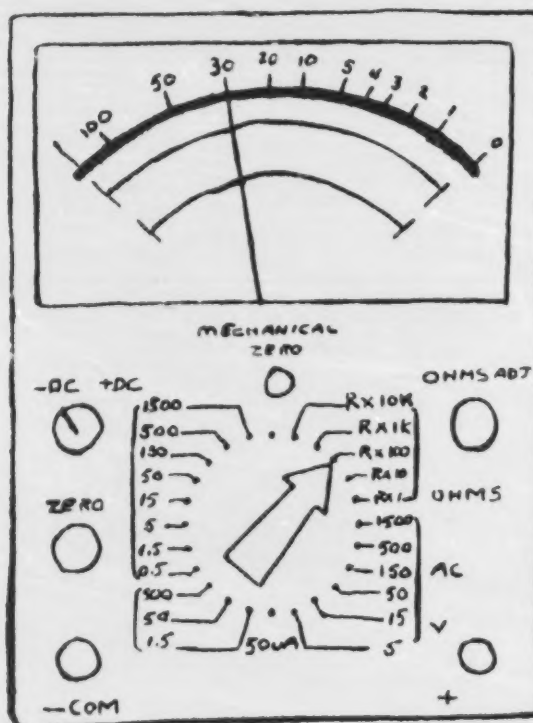
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. What is each scale of the vom used for?
2. TRUE or FALSE. The electronic type vom which uses vacuum tubes is called a VTVM.
3. Look at the following meter and tell what the needle reads.



NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a VOM Does					
Knowing What Scales Are On a VOM					
Seeing How to Measure Voltage, Current and Resistance					
Measuring Resistance With the VOM					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Measure Values in Simple Circuits

LEARNING OBJECTIVES:

1. Measure Current Flow in a Series Circuit

Activities:

- a. Read pages 205 to 214 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a series circuit.
- c. On the worksheet, solve the problems for the series circuit.

Materials:

None

2. Measure Current Flow in a Parallel Circuit

Activities:

- a. Read pages 229 to 242 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a parallel circuit.
- c. On the worksheet, solve the problems for the parallel circuit.

Materials:

None

3. Measure Current Flow in a Series-Parallel Circuit

Activities:

- a. Read pages 255 to 268 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a series-parallel circuit.

- c. On the worksheet, solve the problems for the series-parallel circuit.
- d. Watch the movie: Series-Parallel Resistive Circuits: Circuit Analysis.

Materials:

None

EVALUATION:

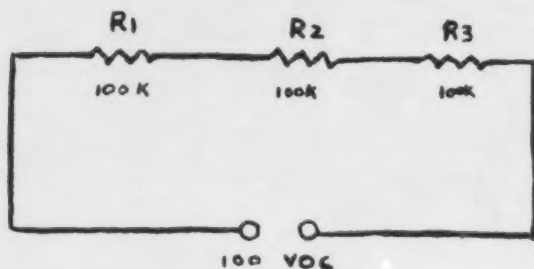
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Wire the circuits found on the worksheet and measure the values with the VOM. Have your instructor check your work.
3. Complete the attitude sheet.

RESOURCES:

Kaufman, Milton and Wilson, J. A. Basic Electricity: Theory and Practice. New York, New York, McGraw-Hill Book Co., 1973.

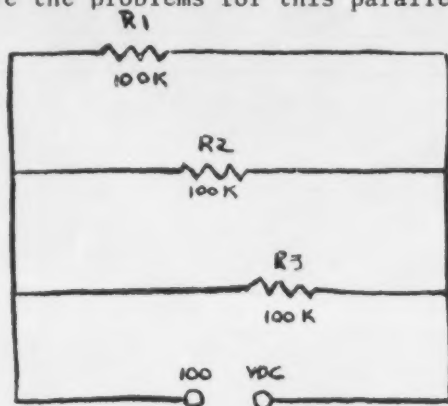
WORKSHEET

1. Solve the problems for this series circuit:



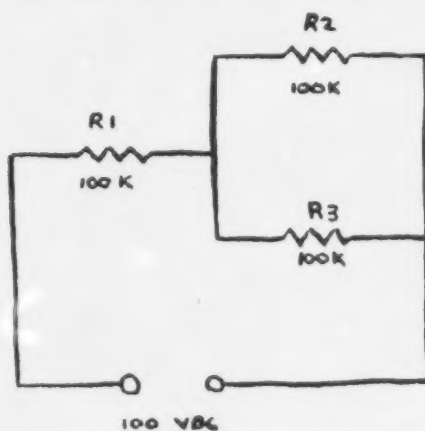
- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance of the circuit? _____

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance of the circuit? _____

3. Solve the problems for this series-parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the voltage drop at R_2 ? _____
- What is the current at R_3 ? _____
- What is the total resistance of the circuit? _____

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How Current Flows in a Series Circuit					
Learning How Current Flows in a Parallel Circuit					
Learning How Current Flows in a Series-Parallel Circuit					
Measuring Current Flow in Simple Circuits					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Discuss Electromagnetism

LEARNING OBJECTIVES:

1. Tell How an Electromagnet Works

Activities:

- a. Read page 50 in Electricity and Electronics.
- b. Watch a demonstration on how an electromagnet works.
- c. On the worksheet, explain the role of electrons in an electromagnet.
- d. On the worksheet, draw a simple electromagnet and label the parts.

Materials:

None

2. List Four Things That Affect the Strength of an Electromagnet

Activities:

- a. Read pages 50 to 51 in Electricity and Electronics.
- b. Watch a demonstration showing the four things that affect the strength of an electromagnet.
- c. On the worksheet, list the four things that affect the strength of an electromagnet.
- d. Make a simple electromagnet.

Materials:

Wire, iron bar, battery

3. Discuss the Left Hand Rule for Electromagnets

Activities:

- a. Read page 76 to 78 in Electric Motor Repairman.

- b. Watch a demonstration showing the left hand rule for electromagnets.
- c. On the worksheet, define the left hand rule for electromagnets.

Materials:

None

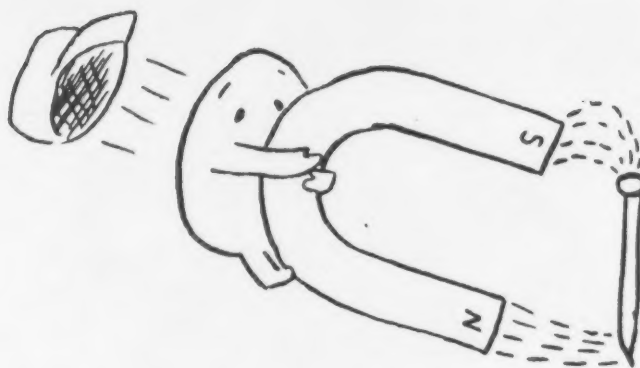
EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Sutton, Mark C. Electric Motor Repairman. Austin, Texas, University of Texas, 1973.

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Explain the role of electrons in an electromagnet.

2. In the space provided, draw a simple electromagnet and label the parts.

3. List four things which affect the strength of an electromagnet.

4. Define the left-hand rule for electromagnets.

5. TRUE or FALSE. Electrons moving through a wire create a magnetic field.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How an Electromagnet Works					
Seeing How Some Things Affect the Strength of an Electromagnet					
Knowing the Left Hand Rule					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Describe How Alternating Current Is Generated

LEARNING OBJECTIVES:

1. Define Alternating Current

Activities:

- a. Read pages 57 to 58 in Electricity and Electronics.
- b. Watch a demonstration defining alternating current.
- c. On the worksheet, define alternating current.

Materials:

None

2. Identify Peak Voltage, RMS and Frequency

Activities:

- a. Read page 58 in Electricity and Electronics.
- b. Watch a demonstration identifying peak voltage, RMS and frequency.
- c. On the worksheet, compute peak voltage, RMS and frequency.

Materials:

None

3. Tell How an Armature in a Magnetic Field Makes Alternating Current

Activities:

- a. Read page 57, Figure 22-2, in Electricity and Electronics.
- b. Watch a demonstration on how an armature in a magnetic field makes alternating current.
- c. On the worksheet, explain how an armature in a magnetic field makes alternating current.

Materials:

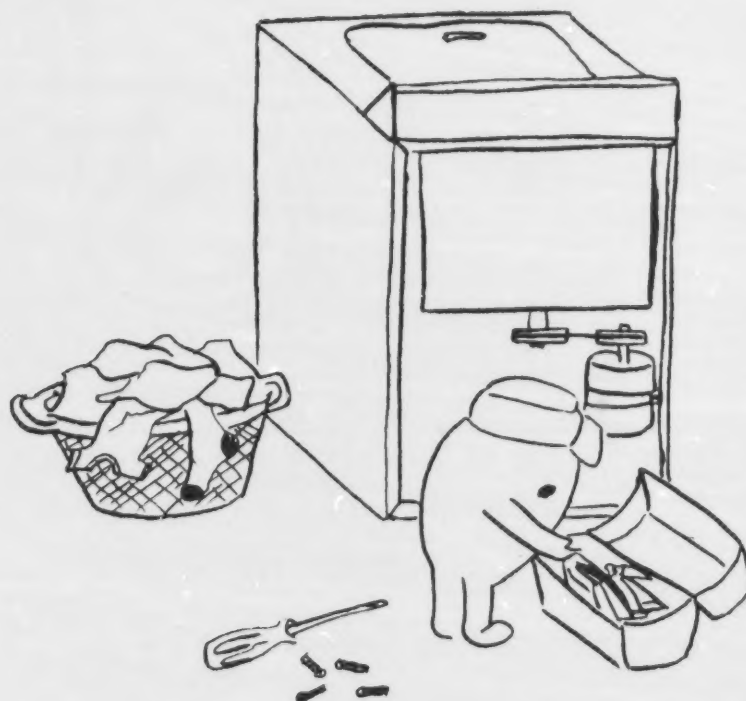
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

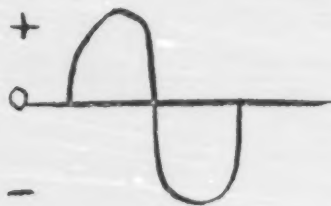
Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



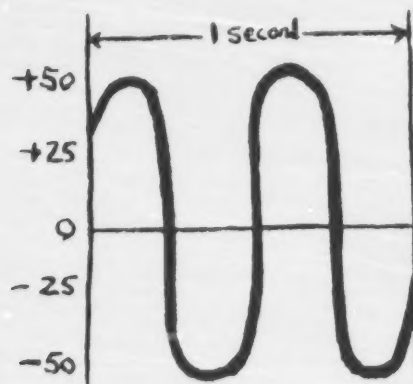
WORKSHEET

1. Define alternating current.

2. Identify the following figure and explain its meaning for alternating current:



3. From the figure below, compute the following:



a. peak voltage _____

b. RMS _____

c. frequency _____

4. Explain how an armature in a magnetic field makes alternating current.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Alternating Current					
Learning About Peak Voltage, RMS and Frequency					
Seeing How Alternating Current Can Be Made With an Armature					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Describe How a Transformer Works

LEARNING OBJECTIVES:

1. Identify Primary and Secondary Windings in a Transformer

Activities:

- a. Read page 69 in Electricity and Electronics.
- b. Watch a demonstration defining a transformer and identifying primary and secondary windings.

Materials:

None

2. Tell How a Transformer Works

Activities:

- a. Read pages 69 to 70 in Electricity and Electronics.
- b. Watch a demonstration explaining the relationship of the windings of a transformer to voltage.
- c. On the worksheet, explain how the transformer operates.
- d. Watch the movie: Transformers - Laboratory.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Define transformer.
2. What kind of current is a transformer often used with?
3. A transformer has a primary winding of 50 turns and a secondary winding of 500 turns. If 120 volts AC is connected to the primary, what will be the voltage at the secondary?
4. If the transformer in question 3 had only 5 turns in the secondary what would the secondary voltage be?
5. How does a transformer operate?
6. TRUE or FALSE. The power found in the primary of a transformer always equals the power in the secondary.

NAME _____

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STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing What a Transformer Is					
Learning How a Transformer Works					
Identifying the Windings of a Transformer					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Identify the Parts of the DC Motor

LEARNING OBJECTIVES:

1. Name the Main Parts of the DC Motor

Activities:

- a. Read page 52, Figure 20-1, in Electricity and Electronics.
- b. Watch a demonstration on the main parts of a DC motor.
- c. On the worksheet, identify the main parts of a DC motor.
- d. Watch the movie: DC Motors.

Materials:

None

2. Discuss the Role of Brushes, Slip-Rings and Commutators

Activities:

- a. Read page 52 in Electricity and Electronics.
- b. Watch a demonstration on the role of brushes, slip-rings and commutators.
- c. On the worksheet, tell the role of brushes, slip-rings and commutators.

Materials:

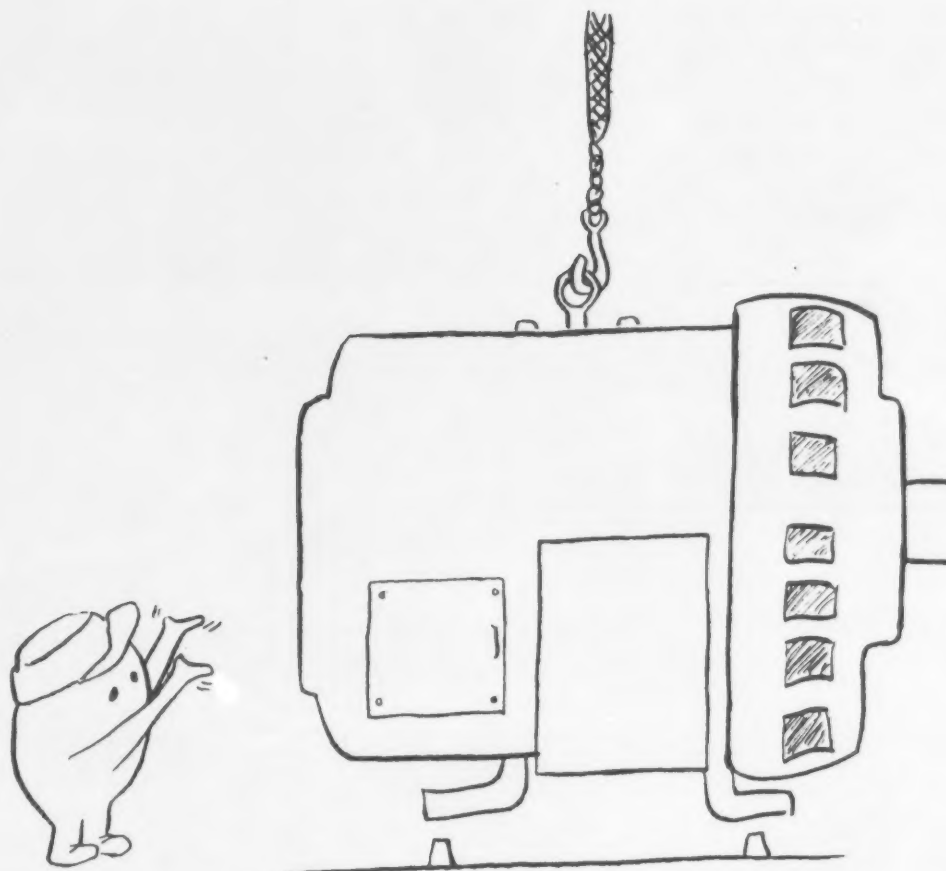
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Disassemble an electric motor and identify its principal parts.
3. Complete the attitude sheet.

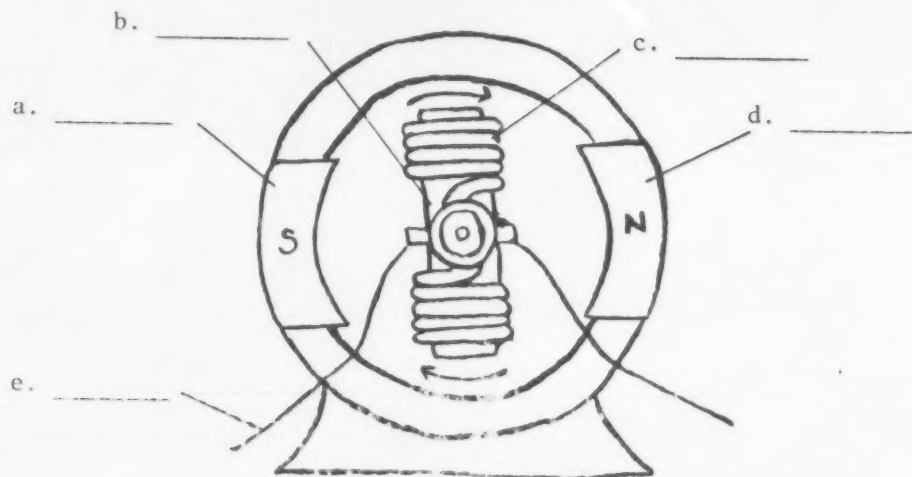
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois,
American Technical Society, 1979.



WORKSHEET

1. Identify the parts of the DC motor:



2. Tell the roles of the following motor parts:

- a. brushes
- b. slip rings
- c. commutators

3. TRUE or FALSE. The electromagnet in a motor is called the armature.

4. TRUE or FALSE. The fixed magnets in a motor are called brushes.

NAME _____

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STUDENT ATTITUDE SHEET

for

CLUSTER _____

MANUFACTURING

UNIT _____

MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Parts Of a DC Motor					
Seeing What the Brushes, Slip-Rings and Commutators Do In a DC Motor					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

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LESSON 8

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Describe How a Motor Works

LEARNING OBJECTIVES:

1. Tell Why Brushes Are Made of Graphite

Activities:

- a. Read page 53 in Electricity and Electronics.
- b. Watch a demonstration on brushes and their construction.
- c. On the worksheet, explain why brushes are made of graphite.

Materials:

None

2. Explain How an Electric Motor Works

Activities:

- a. Read pages 52 to 54 and Figure 20-4 in Electricity and Electronics.
- b. Watch a demonstration explaining how a motor works.
- c. On the worksheet, explain how a motor works.
- d. Watch the movie: Electric Motors.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning Why Brushes Are Made Of Graphite					
Learning How a Motor Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Describe How a Generator Works

LEARNING OBJECTIVES:

1. Name the Main Parts of the Generator

Activities:

- a. Read page 55 in Electricity and Electronics.
- b. Watch a demonstration on the main parts of a generator.
- c. On the worksheet, identify the parts of a generator.
- d. On the worksheet, explain why the generator looks like a motor.

Materials:

None

2. Tell How a Generator Works

Activities:

- a. Read pages 55 to 56 in Electricity and Electronics.
- b. Watch a demonstration telling how a generator works.
- c. On the worksheet, tell how a generator works.
- d. Watch the movie: Fundamentals of AC and DC Generation.

Materials:

None

3. Explain How the Operation of a Generator Compares to a Motor

Activities:

- a. Read pages 55 to 56 in Electricity and Electronics.
- b. Watch a demonstration comparing the operation of a generator to a motor.

- c. On the worksheet, tell how the operation of a generator compares to a motor.
- d. Watch the movie: Electricity - The Generator and the Motor.

Materials:

None

EVALUATION:

1. Disassemble a simple generator and try to identify the parts.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

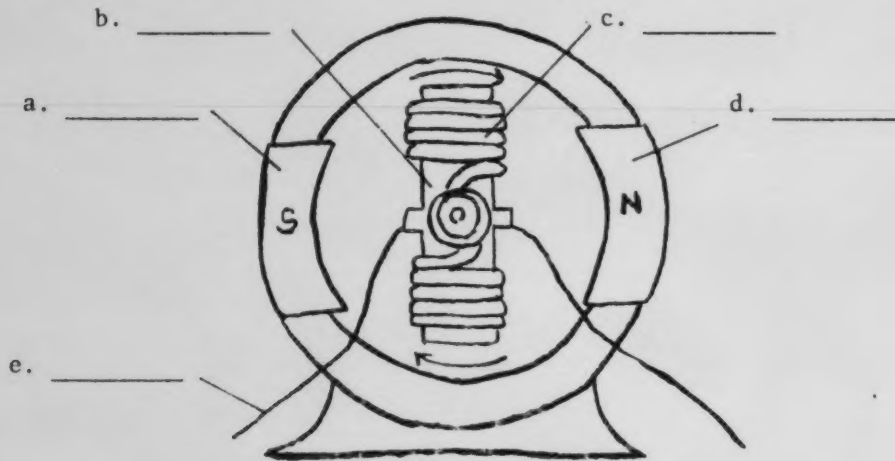
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Identify the parts of the generator:



2. Why does the generator look like a motor?

3. How does a generator work? How does it compare to a motor?

4. TRUE or FALSE. The faster the generator turns-the lower the voltage will be.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT MOTOR REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing the Parts Of a Generator					
Learning How a Generator Works					
Comparing a Generator To a Motor					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Motor Repairer

OCCUPATIONAL COMPETENCY: Show How to Clean and Maintain an Electric Motor

LEARNING OBJECTIVES:

1. Tell Why a Motor Overheats

Activities:

- a. Read page 11 in Electric Motor Repairman.
- b. Watch a demonstration on why a motor overheats.
- c. On the worksheet, list five reasons why a motor would overheat.

Materials:

None

2. Service an Electric Motor

Activities:

- a. Read pages 9 to 10 in Electric Motor Repairman.
- b. Watch a demonstration on how to service an electric motor.
- c. On the worksheet, list the steps in the general servicing of an electric motor.
- d. Watch the movie: Lubrication of Electronic Equipment.

Materials:

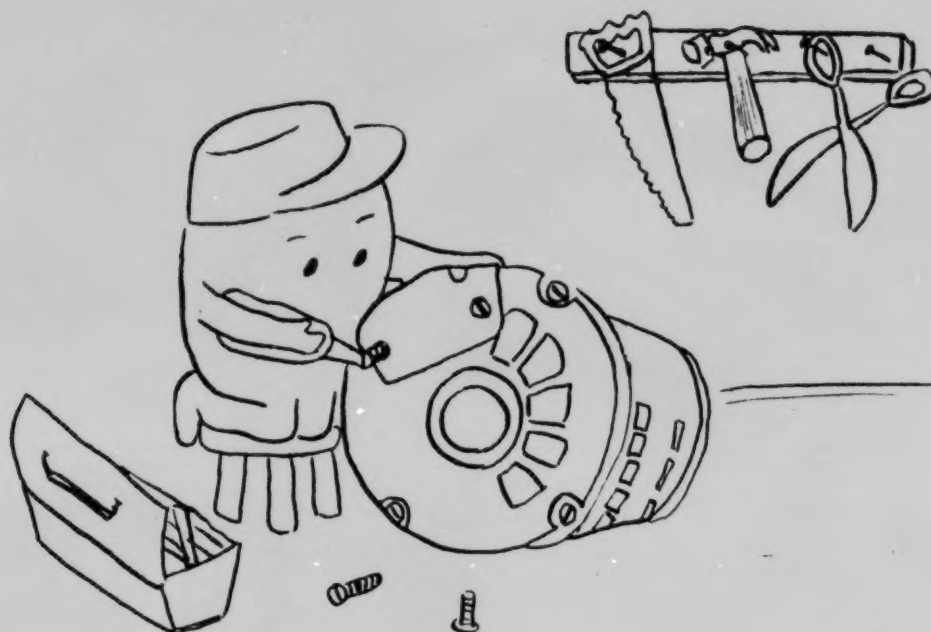
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Sutton, Mark C. Electric Motor Repairman. Austin, Texas, University of Texas, 1973.

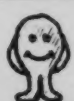


STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ MOTOR REPAIRER _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing Why a Motor Overheats					
Learning How To Service an Electric Motor					
Cleaning and Lubricating an Electric Motor					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

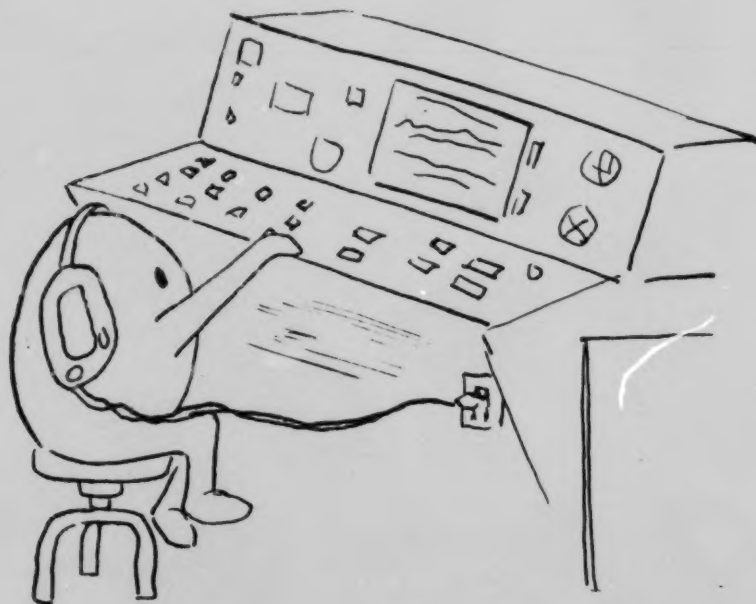
UNIT OF STUDY: Industrial Electronics Technician

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Electrical Assembling, Installing and Repairing

DOT OCCUPATIONAL GROUP: Fabrication, Installation and Repair of
Electrical and Electronics Products

OCCUPATIONAL OVERVIEW: The industrial electronics mechanic repairs electronic equipment, such as computers, industrial controls, radar systems and transmitters. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose problem. Replaces defective components, wires connections and calibrates equipment. May install equipment in industrial, military or residential establishments.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

828.281-010	Electronics Mechanic
828.261-014	Field Engineer
828.381-010	Equipment Installer
828.381-014	Precision Assembler
726.684-018	Electronics Assembler
003.161-014	Electronics Technician

LESSON 1

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Identify Resistors and Capacitors

LEARNING OBJECTIVES:

1. Identify Resistors and Their Ratings

Activities:

- a. Read pages 24 to 26 in Electricity and Electronics.
- b. Watch a demonstration on resistor construction, color code, and ratings.
- c. From an assortment of resistors, identify the resistance and power rating of each.
- d. Watch the movie: Resistors: Color Code.
- e. Watch the movie: Resistors: Construction.

Materials:

Assortment of Resistors

2. Identify Capacitors and Their Ratings

Activities:

- a. Read pages 63 to 66 in Electricity and Electronics.
- b. Watch a demonstration on capacitor operation, types, and ratings.
- c. From an assortment of capacitors, identify the rating and type of each.
- d. Watch the movie: Capacitors.

Materials:

Assortment of capacitors

EVALUATION:

1. Get a group of resistors and capacitors from your instructor and identify:
 - a. type
 - b. rating
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

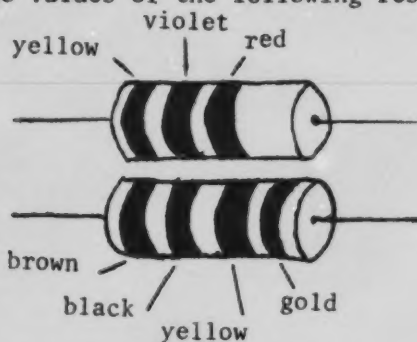
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Read the values of the following resistors:



a. resistance _____

b. tolerance _____

a. resistance _____

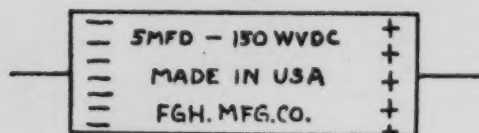
b. tolerance _____

2. Solve the following problems for resistor wattage ratings:

a. Current flowing through a resistor measures .2 amperes at 10 volts. What should the wattage rating of the resistor be? _____

b. A resistor has a rating of 20,000 ohms. 100 volts of electricity is applied across the resistor. What should the wattage rating of the resistor be? _____

3. Identify the following:



a. type _____

b. capacitance _____

c. voltage _____



a. type _____

b. capacitance _____

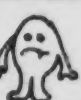
c. voltage _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Resistors and Their Ratings					
Identifying Capacitors and Their Ratings					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Identify Electron Tubes

LEARNING OBJECTIVES:

1. Describe the Two Uses of Electron Tubes

Activities:

- a. Read page 5 in Basic Electronics, Vol. 2.
- b. Watch a demonstration on the uses of electron tubes.
- c. Describe the two uses of electron tubes.

Materials:

None

2. Name the Four Main Types of Electron Tubes

Activities:

- a. Read pages 7 to 8 in Basic Electronics, Vol. 2.
- b. Watch a demonstration on the four main types of electron tubes.
- c. Name the four main types of electron tubes.
- d. Look at the schematic symbols of the four main types of electron tubes and identify each.

Materials:

Schematic symbols of four types of electron tubes

3. Name the Parts of the Four Types of Electron Tubes

Activities:

- a. Read page 8 in Basic Electronics, Vol. 2.
- b. Watch a demonstration on the parts of electron tubes.

- c. Name the parts of each of the four main types of electron tubes.
- d. Tell what each part of an electron tube does.
- e. Explain how the pin base of an electron tube is read.

Materials:

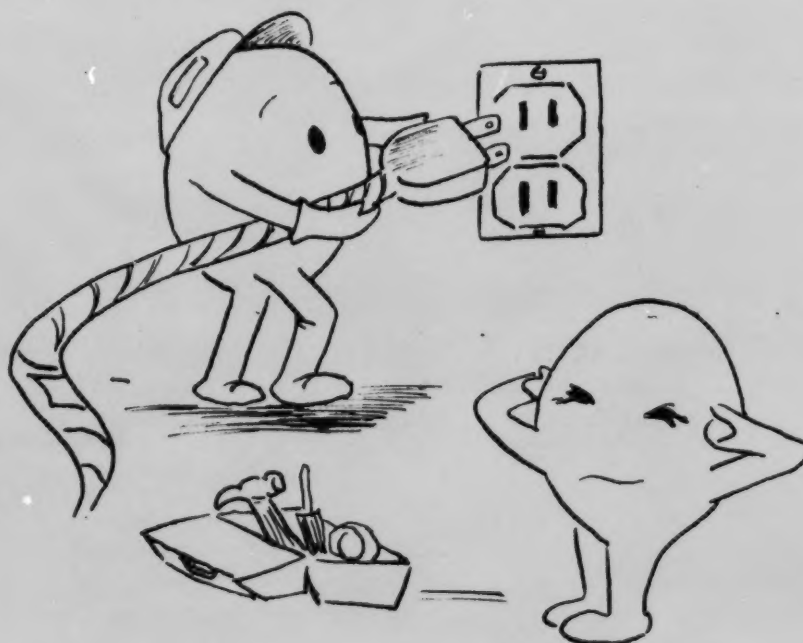
None

EVALUATION:

1. Get a group of electron tubes from your instructor and identify each by:
 - a. type
 - b. use
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

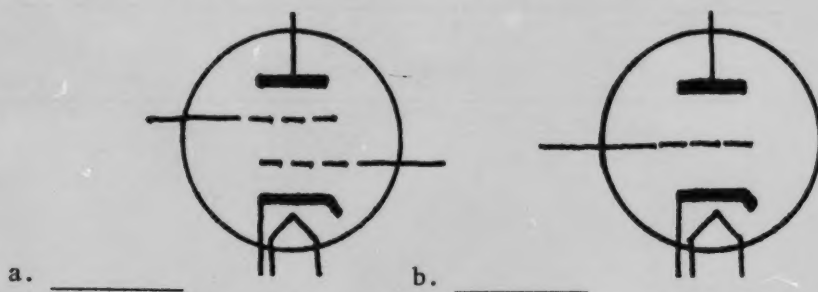
RESOURCES:

Van Valkenburgh, Nooger & Neville, Inc. Basic Electronics, Vol. 2.
New York, John F. Rider Publisher, Inc., 1955.

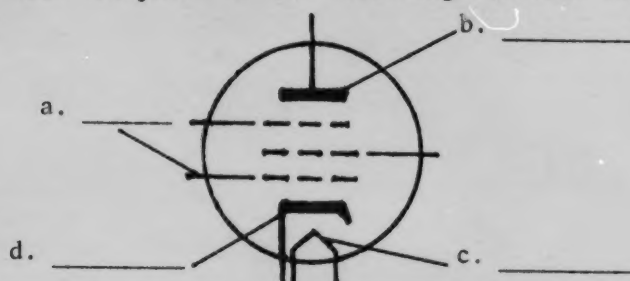


WORKSHEET

1. Identify the following types of electron tubes:



2. Name the parts of the following electron tube:



3. Describe what the filament does in an electron tube.

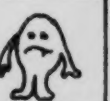
4. Look in a tube manual and tell what type of tube a 12AX7 is. What is its filament voltage?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What Electron Tubes Are Used For					
Finding Out About the Different Types of Electron Tubes					
Naming the Parts of a Electron Tube					
Identifying Electron Tubes					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Identify Semi-Conductors

LEARNING OBJECTIVES:

1. Tell How Diodes and Transistors Are Made

Activities:

- a. Read pages 76 to 78 in Electricity and Electronics.
- b. Watch a demonstration how diodes and transistors are made.
- c. On the worksheet, identify the parts of the common transistors.
- d. Watch the movie: The Transistor.
- e. Watch the movie: Semi-Conductors.

Materials:

None

2. Tell How a Diode Works

Activities:

- a. Read pages 76 to 77 in Electricity and Electronics.
- b. Watch a demonstration on what a diode does and how it works.
- c. On the worksheet, explain how a diode works.
- d. Define "depletion zone".
- e. Look in a parts manual and identify the working characteristics of some diodes.

Materials:

Parts manual

3. Explain How a Transistor Works

Activities:

- a. Read pages 79 to 80 in Electricity and Electronics.
- b. Watch a demonstration on how a transistor works.
- c. On the worksheet, tell how a transistor works.
- d. Tell the three types of gain that a transistor can provide.
- e. Look in a parts manual and identify the working characteristics of some transistors.

Materials:

Parts manual

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

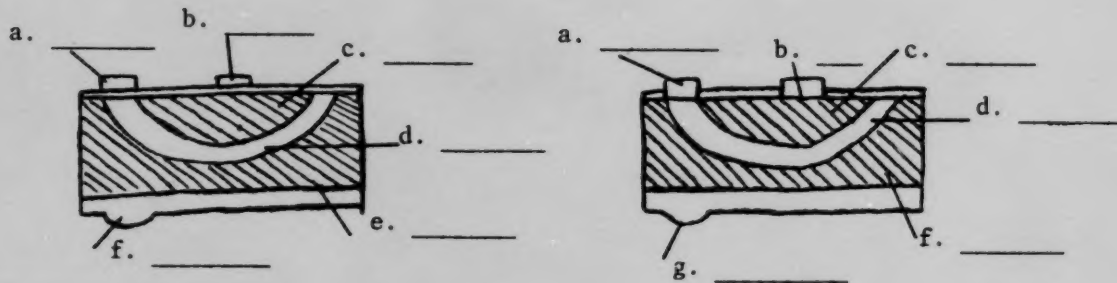
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. In the following drawings, identify the parts of the two kinds of basic transistors:



2. Tell the role of the following transistor parts:

emitter:

base:

collector:

3. Name the two basic kinds of transistors.

4. Draw a diode and explain how it works.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How Semi-Conductors are Made					
Learning How a Diode Works					
Learning How a Transistor Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Operate Test Equipment

LEARNING OBJECTIVES:

1. Operate the VOM

Activities:

- a. Read pages 59 to 61 in Electricity and Electronics.
- b. Watch a demonstration on the use and operation of a VOM.
- c. Look at a VOM and identify the three scales.
- d. Tell how to measure voltage, current and resistance with the VOM.
- e. Practice measuring the ratings of some resistors with the VOM.
- f. Watch the movie: Use of Voltmeter.

Materials:

VOM, resistors

2. Operate the Oscilloscope

Activities:

- a. Read pages 278 to 286 in Technical Electricity and Electronics.
- b. Watch a demonstration on the use and operation of the oscilloscope.
- c. Look at an oscilloscope and identify the controls and what they do.
- d. Tell how to set up the oscilloscope to measure AC voltage.
- e. Practice measuring AC voltage with the oscilloscope.
- f. Watch the movie: Use of the Oscilloscope.

Materials:

Oscilloscope, AC voltage source

3. Operate the Audio-Signal Generator**Activities:**

- a. Read pages 287 to 288 in Technical Electricity and Electronics.
- b. Watch a demonstration on the use and operation of the audio-signal generator.
- c. Look at an audio-signal generator and identify the controls and what they do.
- d. Practice setting the controls of the audio-signal generator to get different signals.
- e. Watch the movie: Circuit Testing - Signal Generators.

Materials:

Audio-signal generator

EVALUATION:

1. Use the VOM to measure the value of some resistors provided by the teacher.
2. On the oscilloscope screen, view the wave form and read the value of a signal from the audio-signal generator.
3. Complete the worksheet and submit it to your instructor for evaluation.
4. Complete the attitude sheet.

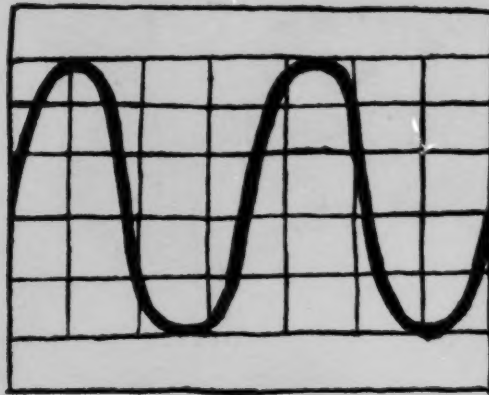
RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, McGraw-Hill Book Co., 1972.

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. What does the following waveform tell you about the voltage being tested with an oscilloscope?



2. If an audio signal generator was set at X10 on the frequency range control and the tuning pointer was adjusted to 50 cycles, what frequency would be produced?
3. What is each scale of the VOM used for?
4. If a VOM was set at R x 10K on the range control and the meter needle pointed to 30 on the resistance scale, what would the rating be of resistor being tested?
5. TRUE or FALSE. VOM stands for voltage operating meter.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Use Test Equipment					
Using the VOM					
Using the Oscilloscope					
Using an Audio-Signal Generator					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Interpret Schematic Drawings

LEARNING OBJECTIVES:

1. Identify Schematic Symbols

Activities:

- a. Read pages 309 to 311 in Technical Electricity and Electronics.
- b. Watch a demonstration on the identification of schematic symbols.
- c. Look at circuit diagrams and practice identifying components by their schematic symbols.
- d. On the worksheet, identify schematic symbols.

Materials:

Circuit diagrams

2. Outline the Rules and Practices in Drawing Schematics

Activities:

- a. Read page 311 and pages 314 to 317 in Technical Electricity and Electronics.
- b. Watch a demonstration on the rules and practices in drawing schematics.
- c. On the worksheet, list the rules for drawing schematics.

Materials:

None

3. Discuss Schematic Designations and Numerical Values

Activities:

- a. Read page 313 in Technical Electricity and Electronics.

- b. Watch a demonstration on how to identify schematic designations and numerical values.
- c. Look at circuit diagrams and try to identify schematic designations and numerical values of various components.

Materials:

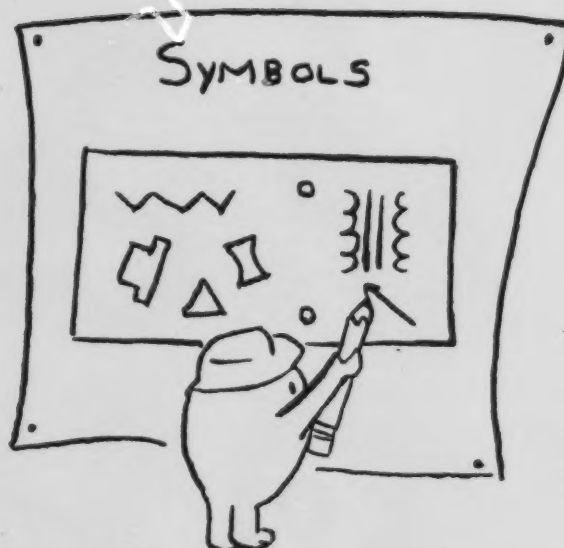
Circuit diagrams

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, McGraw-Hill Book Co., 1972.

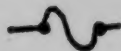


WORKSHEET

1. Identify these schematic symbols:



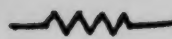
a. _____



b. _____



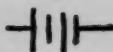
c. _____



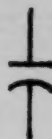
d. _____



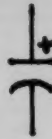
e. _____



f. _____



g. _____



h. _____



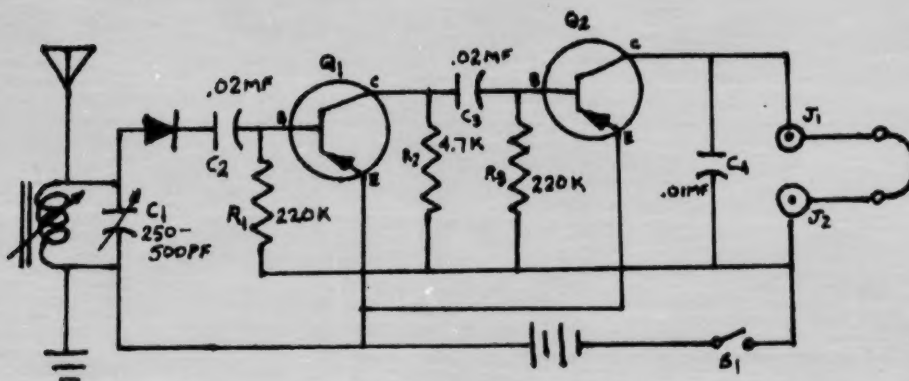
i. _____



j. _____

2. List the rules for drawing schematics.

3. Look at the schematic diagram and identify the following:



- What component is shown at C_4 ? _____
- What is the value of R_2 ? _____
- At Q_1 , what does the letter B mean? _____
- What is the value of C_1 ? _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Electrical Components by Their Schematic Symbol					
Identifying Component Ratings in Schematic Drawings					
Learning How to Make Schematic Drawings					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Measure Values in Simple Circuits

LEARNING OBJECTIVES:

1. Measure Current Flow in a Series Resistance Circuit

Activities:

- a. Read pages 205 to 214 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a series circuit.
- c. On the worksheet, solve the problems for the series circuit.

Materials:

None

2. Measure Current Flow in a Parallel Resistance Circuit

Activities:

- a. Read pages 229 to 242 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a parallel circuit.
- c. On the worksheet, solve the problems for the parallel circuit.

Materials:

None

3. Measure Current Flow in a Series-Parallel Resistance Circuit

Activities:

- a. Read pages 255 to 268 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a series/parallel circuit.

- c. On the worksheet, solve the problems for the series/parallel circuit.
- d. Watch the movie: Series - Parallel Resistor Circuits: Circuit Analysis.

Materials:

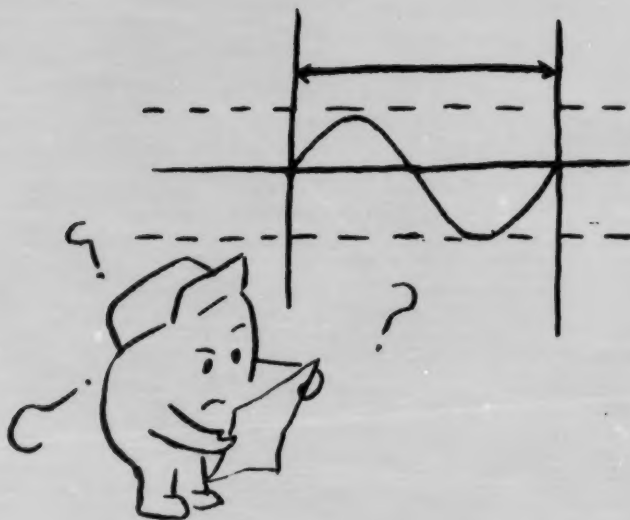
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Wire the circuits found on the worksheet and measure the values with the VOM. Have your instructor check your work.
3. Complete the attitude sheet.

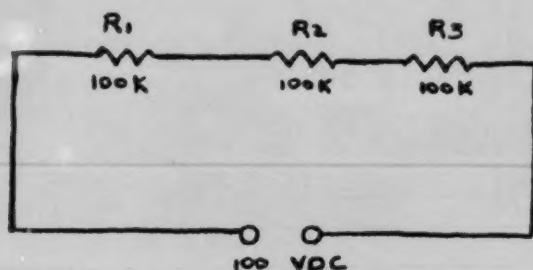
RESOURCES:

Kaufman, Milton and Wilson, J. A. Basic Electricity: Theory and Practice. New York, McGraw-Hill Book Co., 1973.



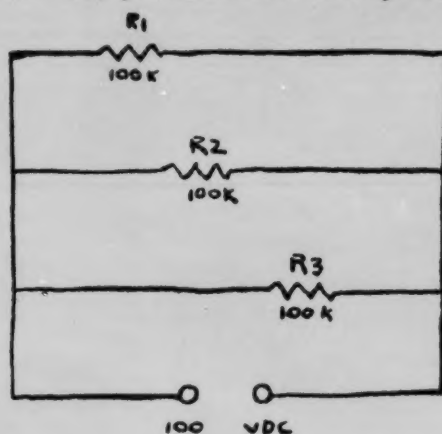
WORKSHEET

1. Solve the problems for this series circuit:



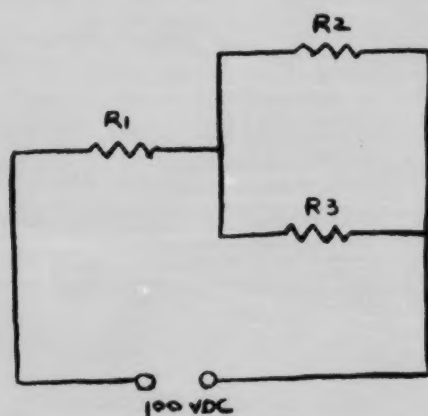
- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance of the circuit? _____

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance of the circuit? _____
- What is the total current flow of the circuit? _____

3. Solve the problems for this series - parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the voltage drop at R_2 ? _____
- What is the current at R_3 ? _____
- What is the total resistance of the circuit? _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Current Flow in Electrical Circuits					
Wiring Simple Electrical Circuits					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Use Electronic Sensors

LEARNING OBJECTIVES:

1. Describe the Operation and Use of the Phototube

Activities:

- a. Read pages 60 to 68 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the phototube.
- c. Identify the schematic symbols for the various phototubes.
- d. Tell where a phototube might be used in an electronic circuit.

Materials:

None

2. Describe the Operation and Use of the Photovoltaic Cell

Activities:

- a. Read pages 68 to 69 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the photovoltaic cell.
- c. Identify the schematic symbol for the photovoltaic cell.
- d. Explain how a photovoltaic cell operates.
- e. Tell where a photovoltaic cell is used.

Materials:

None

3. Describe the Operation and Use of the Photoconductive Cell

Activities:

- a. Read pages 69 to 71 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the photoconductive cell.
- c. Identify the schematic symbol for the photoconductive cell.
- d. Explain how a photoconductive cell operates.
- e. Tell where a photoconductive cell is used.

Materials:

None

EVALUATION:

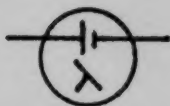
1. Get a photovoltaic cell from your instructor and connect a VOM to it. Set the VOM to a low DC voltage range and observe the value. Cover the cell with your hand and watch the value change.
2. Repeat the experiment with an ohmmeter and a photoconductive cell.
3. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
4. Complete the attitude sheet.

RESOURCES:

Marcus, Abraham. Automatic Industrial Controls. Englewood Cliffs, N.J., Prentice-Hall, Inc., 1966.

WORKSHEET

1. Identify these schematic symbols:



a. _____



b. _____



c. _____

2. Compare the operation of photovoltaic and photoconductive cells.

3. Draw a selenium cell and identify its parts.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What Phototubes are Used For					
Seeing How a Photovoltaic Cell Operates					
Seeing How a Photoconductive Cell Operates					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Identify Counters

LEARNING OBJECTIVES:

1. Describe the Operation and Use of Electric Counters

Activities:

- a. Read pages 120 to 124 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of electric counters.
- c. Name and describe three electric counter actuators.
- d. Tell three places where an electric counter is found.

Materials:

None

2. Describe the Operation and Use of Binary Electronic Counters

Activities:

- a. Read pages 124 to 132 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of binary electronic counters.
- c. Describe the operation of a simple flip-flop binary counter.
- d. Define "cascading".

Materials:

None

3. Describe the Operation and Use of Decade Electronic Counters

Activities:

- a. Read pages 132 to 137 in Automatic Industrial Controls.

- b. Watch a demonstration on the operation and use of decade electronic counters.
- c. Explain how a decade electronic counter operates.
- d. Tell where a decade electronic counter is found.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Marcus, Abraham. Automatic Industrial Controls. Englewood Cliffs, N.J., Prentice-Hall, Inc., 1966.

WORKSHEET

1. Name five places where counters are used.

2. Name and describe three electric counter actuators.

3. Describe the operation of a simple flip-flop binary counter.

4. Draw the schematic symbol for a decade electronic counter.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing How an Electric Counter Works					
Learning How a Binary Electronic Counter Operates					
Learning How a Decade Electronic Counter Operates					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Discuss How Time Is Measured

LEARNING OBJECTIVES:

1. Describe the Operation and Use of the Clock Timer

Activities:

- a. Read pages 139 to 141 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the clock timer.
- c. Tell when a clock timer is used to measure time duration.
- d. Explain the operation of the clock timer.
- e. Name five timers.

Materials:

None

2. Describe the Operation and Use of the Electronic Time-Delay Relay

Activities:

- a. Read pages 142 to 149 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the electronic time-delay relay.
- c. Explain the operation of an electronic time-delay relay.
- d. Tell where an electronic time-delay relay is used.

Materials:

None

3. Describe the Operation and Use of a Time-Interval Counter

Activities:

- a. Read pages 149 to 154 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of a time-interval counter.
- c. Explain how a time-interval counter operates.
- d. Explain how the speed of a bullet is measured.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Marcus, Abraham. Automatic Industrial Controls. Englewood Cliffs, N.J., Prentice-Hall, Inc., 1966.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing What a Clock Timer is Used For					
Learning How an Electronic Time-Delay Relay Operates					
Learning How a Time Interval Counter Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Industrial Electronics Technician

OCCUPATIONAL COMPETENCY: Identify Electrical Contactors

LEARNING OBJECTIVES:

1. Discuss the Major Parts and Types of Electrical Switches

Activities:

- a. Read pages 185 to 191 in Automatic Industrial Controls.
- b. Watch a demonstration on the parts and types of electric switches.
- c. Compare a single-pole, single throw switch with a double-pole, single-throw switch.
- d. Identify schematic symbols for electric switches.
- e. From an assortment of electric switches, identify each one by type and operation.

Materials:

Assortment of switches

2. Describe the Operation and Use of the Electromagnetic Relay

Activities:

- a. Read pages 192 to 204 in Automatic Industrial Controls.
- b. Watch a demonstration on the operation and use of the electromagnetic relay.
- c. Describe how an electromagnetic relay operates.
- d. Identify the parts of an electromagnetic relay.
- e. Identify the schematic symbol for electromagnetic relays.

Materials:

None

3. Name and Describe the Three Main Types of Electronic Relays

Activities:

- a. Read pages 204 to 215 in Automatic Industrial Controls.
- b. Watch a demonstration on the three main types of electronic relays.
- c. Name and describe the three main types of electronic relays.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Marcus, Abraham. Automatic Industrial Controls. Englewood Cliffs, N.J., Prentice-Hall, Inc., 1966.

WORKSHEET

1. Draw an electromagnetic relay, label its parts and describe its operation.

2. List five different types of switches.

3. Name and describe three main types of electronic relays.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT INDUSTRIAL ELECTRONICS TECHNICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Types of Electrical Switches					
Finding Out How an Electromagnetic Relay Operates					
Knowing the Three Types of Electronic Relays					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Radio and Television Repairer

DOT OCCUPATIONAL CATEGORY: Benchwork

DOT OCCUPATIONAL DIVISION: Assembly and Repair of Electrical Equipment

DOT OCCUPATIONAL GROUP: Assembly and Repair of Radio and Television
Receiving Sets and Phonographs

OCCUPATIONAL OVERVIEW: The radio and television repairer adjusts and repairs radios and television receivers using hand tools and electronic testing instruments. Tunes receivers, adjusts controls, examines chassis for defects, tests voltages and changes components. Solders connections and repairs defective parts. May repair related audio equipment.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

720.281-010	Radio Repairer
720.281-018	Television and Radio Repairer
720.281-014	Tape-Recorder Repairer
720.684-014	Phonograph-Cartridge Assembler
806.684-038	Radio Installer, Automotive
726.281-014	Television-Receiver Analyzer

LESSON 1

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Identify Resistors

LEARNING OBJECTIVES:

1. Read the Resistor Color Code

Activities:

- a. Read pages 24 to 25 in Electricity and Electronics.
- b. Watch a demonstration on reading the resistor color code.
- c. Memorize the resistor color code.
- d. Practice naming a code color and giving its number value.
- e. Watch the movie: Resistors - Color Code.

Materials:

None

2. Tell About Resistor Tolerance Ratings

Activities:

- a. Read page 25 in Electricity and Electronics.
- b. Watch a demonstration on resistor tolerance ratings.
- c. On the worksheet, identify the tolerance of some resistors.

Materials:

None

3. Describe Resistor Wattage Ratings

Activities:

- a. Read pages 25 to 26 in Electricity and Electronics.

- b. Watch a demonstration on the power ratings of resistors.
- c. On the worksheet, solve problems for resistor power ratings.
- d. Watch the movie: Resistors - Construction.

Materials:

None

EVALUATION:

1. Get a group of various resistors from your instructor and identify:
 - a. resistance rating
 - b. tolerance
 - c. wattage rating
2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Give the number value for the following resistor code colors:

_____ Yellow

_____ Black

_____ Brown

_____ Red

_____ Green

_____ Gray

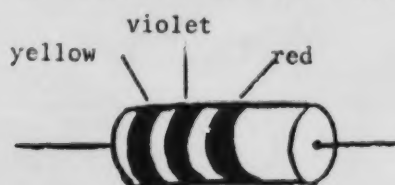
_____ White

_____ Blue

_____ Violet

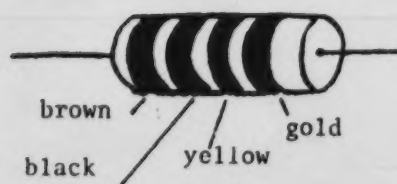
_____ Orange

2. Read the values of the following resistors:



a. resistance _____

b. tolerance _____



a. resistance _____

b. tolerance _____

3. Solve the following problems for resistor wattage ratings:

a. Current flowing through a resistor measures .2 amperes at 10 volts. What should the wattage rating of the resistor be? _____

b. A resistor has a rating of 20,000 ohms. 100 volts of electricity is applied across the resistor. What should the wattage rating of the resistor be? _____

4. TRUE or FALSE. Resistors are made in different wattage sizes so they can fit in a circuit easily.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Reading the Resistor Color Code					
Determining Resistor Tolerance Ratings					
Finding Out Resistor Wattage Ratings					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Identify Capacitors

LEARNING OBJECTIVES:

1. Tell How a Capacitor Operates

Activities:

- a. Read pages 63 to 65 in Electricity and Electronics.
- b. Watch a demonstration on how a capacitor operates.
- c. On the worksheet, explain how a capacitor operates.
- d. On the worksheet, tell what a capacitor is used for.

Materials:

None

2. Describe the Various Types of Capacitors

Activities:

- a. Read page 65 in Electricity and Electronics.
- b. Watch a demonstration on the various types of capacitors.
- c. Practice recognizing capacitors and identifying their types.
- d. Watch the movie: Capacitors.

Materials:

Capacitors

3. Discuss the Two Ratings of a Capacitor

Activities:

- a. Read pages 65 to 66 in Electricity and Electronics.
- b. Watch a demonstration on the two ratings of a capacitor.

- c. Practice identifying the ratings of capacitors.
- d. On the worksheet, name the two ratings of a capacitor.

Materials:

Capacitors

EVALUATION:

1. Get a group of various capacitors from your instructor and:
 - a. identify type of capacitor
 - b. find out capacitance rating
 - c. determine voltage rating
2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. Draw a picture of a simple capacitor and tell how it operates.

2. TRUE or FALSE. A capacitor is rated in farads.

3. What is a capacitor used for?

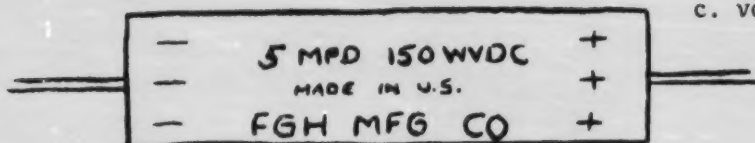
4. Name the two ratings of capacitors.

5. Identify the following:

a. type _____

b. capacitance _____

c. voltage _____



a. type _____

b. capacitance _____

c. voltage _____



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How a Capacitor Works					
Determining Capacitor Ratings and Types					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Identify Transistors

LEARNING OBJECTIVES:

1. Name the Two Basic Kinds of Transistors

Activities:

- a. Read page 78 in Electricity and Electronics.
- b. Watch a demonstration on the construction of transistors.
- c. On the worksheet, identify the two kinds of basic transistors.
- d. Watch the movie: The Transistor.

Materials:

None

2. Discuss the Three Parts of a Transistor

Activities:

- a. Read pages 78 to 79 in Electricity and Electronics.
- b. Read pages 196 to 198 in Technical Electricity and Electronics.
- c. Watch a demonstration on the parts of the transistor and their function.
- d. On the worksheet, name the parts of the transistor and tell their function.
- e. Practice identifying the electrodes of a transistor by observing base pin layout.

Materials:

Transistors

3. Describe How a Transistor Works

Activities:

- a. Read pages 79 to 80 in Electricity and Electronics.
- b. Watch a demonstration on how a transistor works.
- c. On the worksheet, tell how a transistor works.

Materials:

None

EVALUATION:

1. Complete the worksheet. Submit the completed worksheet to your instructor for evaluation.
2. Complete the attitude sheet.

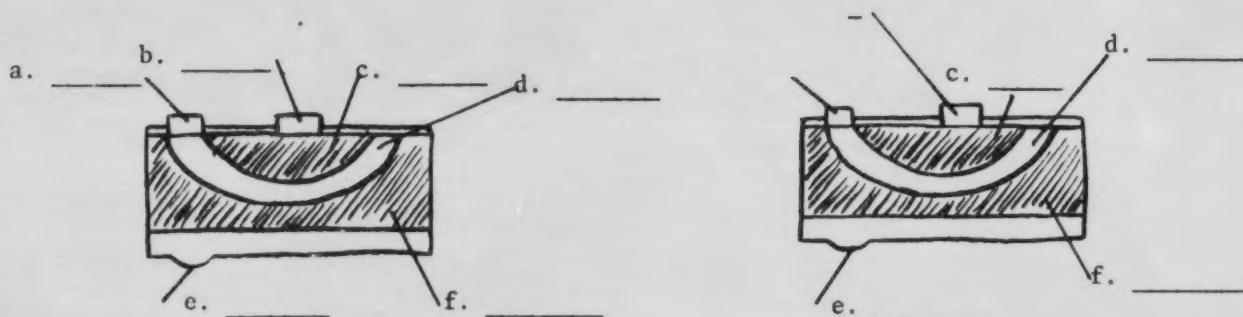
RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, New York, McGraw-Hill Book Co., 1972.

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

WORKSHEET

1. In the following drawings, identify the parts of the two kinds of basic transistors.



2. Tell the role of the following transistor parts:

emitter:

base:

collector:

3. Identify the electrodes in the following base pin layouts:



a. _____



b. _____



c. _____

4. Explain how a transistor works.

5. TRUE or FALSE. The transistor can provide voltage gain, current gain and power gain.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Two Kinds of Transistors					
Knowing the Parts of a Transistor					
Finding Out How a Transistor Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Measure Voltage, Current, and Resistance

LEARNING OBJECTIVES:

1. Identify the Three Scales of the VOM

Activities:

- a. Read page 59 in Electricity and Electronics.
- b. Watch a demonstration on the three scales of the VOM.
- c. Look at a VOM and identify the three scales.
- d. On the worksheet, tell what each scale of the VOM is used for.

Materials:

VOM

2. Measure Voltage, Current, and Resistance

Activities:

- a. Read pages 59 to 61 in Electricity and Electronics.
- b. Watch a demonstration on how to measure voltage, current and resistance with a VOM.
- c. On a simple circuit, practice measuring voltage and current with the VOM.
- d. Practice measuring the ratings of some resistors with the VOM.
- e. Watch the movie: Circuit Testing with Meters and Multi-meters.
- f. Watch the movie: Use of Voltmeter.

Materials:

Simple prepared circuit, VOM, alligator wire leads, resistors

EVALUATION:

1. Get several resistors from your instructor, read the color code, and check resistance ratings with the VOM.
2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

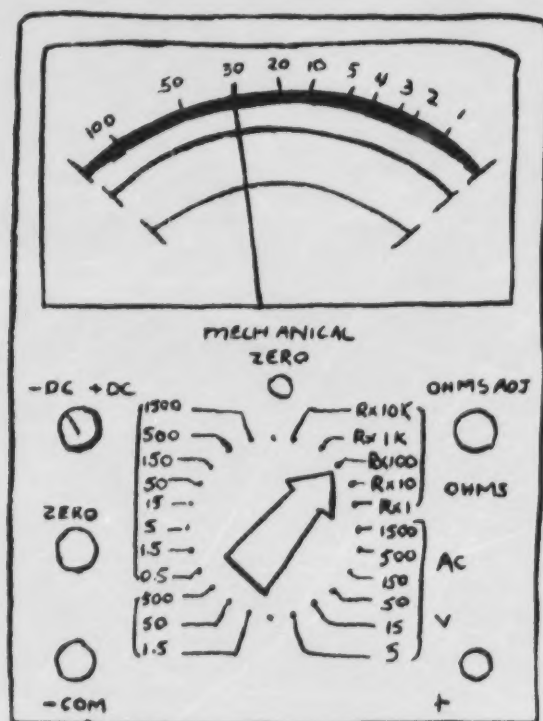
RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. What is each scale of the VOM used for?
2. TRUE or FALSE. The electronic type VOM which uses vacuum tubes is called VTVM.
3. Look at the following meter and tell what the needle reads:



EVALUATION:

1. Get several resistors from your instructor, read the color code, and check resistance ratings with the VOM.
2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.

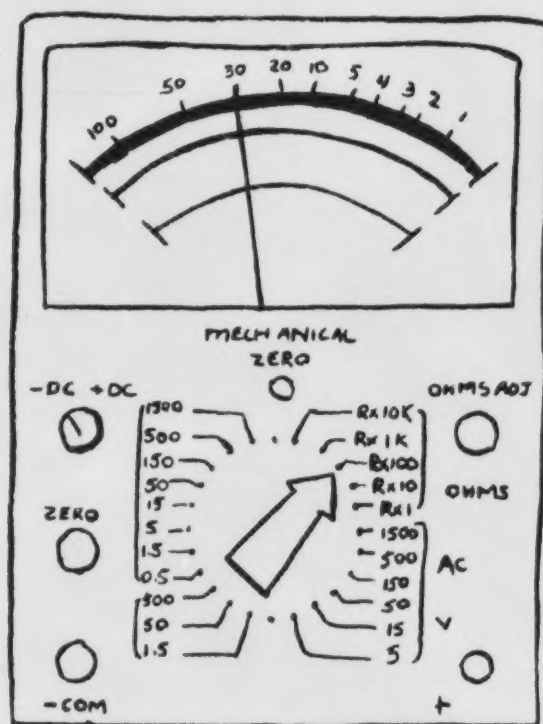


WORKSHEET

1. What is each scale of the VOM used for?

2. TRUE or FALSE. The electronic type VOM which uses vacuum tubes is called VTVM.

3. Look at the following meter and tell what the needle reads:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning what a VOM Does					
Learning What Scales of Measurement the VOM Has					
Checking Resistance with the VOM					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Operate Test Equipment

LEARNING OBJECTIVES:

1. Discuss the Controls on the Oscilloscope

Activities:

- a. Read pages 278 to 286 in Technical Electricity and Electronics.
- b. Watch a demonstration on the controls of the oscilloscope.
- c. Look at an oscilloscope and identify the controls and what they do.

Materials:

Oscilloscope

2. Operate the Oscilloscope

Activities:

- a. Read pages 278 to 286 in Technical Electricity and Electronics.
- b. Watch a demonstration on the operation of the oscilloscope.
- c. On the worksheet, identify the parts of the cathode-ray tube.
- d. Watch the movie: Use of the Oscilloscope.

Materials:

None

3. Discuss the Controls on the Audio-Signal Generator

Activities:

- a. Read pages 287 to 288 in Technical Electricity and Electronics.

- b. Watch a demonstration on the controls of the audio-signal generator.
- c. Look at an audio-signal generator and identify the controls and what they do.

Materials:

Audio-signal generator

4. Operate the Audio-Signal Generator

Activities:

- a. Read pages 287 to 288 in Technical Electricity and Electronics.
- b. Watch a demonstration on the operation of the audio-signal generator.
- c. On the worksheet, explain the function of the audio-signal generator.
- d. Watch the movie: Circuit Testing - Signal Generators.

Materials:

None

EVALUATION:

1. Feed a signal from the audio-signal generator into an oscilloscope and observe the wave form. Read the frequency of the signal on the screen. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

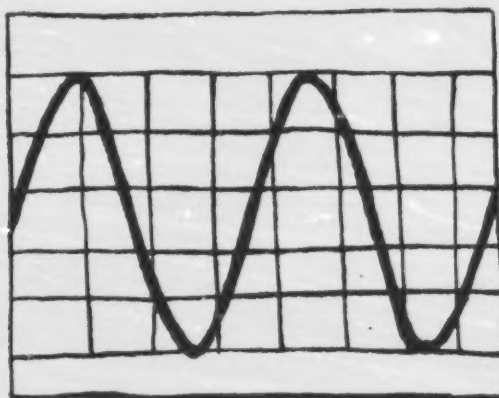
Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, New York, McGraw-Hill Book Co., 1972.

WORKSHEET

1. Draw and identify the parts of the following cathode-ray tube:



2. What does the following waveform tell you about the voltage being tested with an oscilloscope?



3. If an audio signal generator was set at X10 on the frequency range control and the tuning pointer was adjusted to 50 cycles, what frequency would be produced?
4. What is the function of a audio signal generator?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Use the Oscilloscope					
Learning How to Use the Audio-Signal Generator					
Reading Signal Frequencies with Test Equipment					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Interpret Schematic Drawings

LEARNING OBJECTIVES:

1. Identify Schematic Symbols

Activities:

- a. Read pages 309 to 311 in Technical Electricity and Electronics.
- b. Watch a demonstration on the identification of schematic symbols.
- c. Look at circuit diagrams and practice identifying components by their schematic symbols.
- d. On the worksheet, identify schematic symbols.

Materials:

Circuit diagrams

2. Outline the Rules and Practices in Drawing Schematics

Activities:

- a. Read page 311 and pages 314 to 317 in Technical Electricity and Electronics.
- b. Watch a demonstration on the rules and practices in drawing schematics.
- c. On the worksheet, list the rules for drawing schematics.

Materials:

None

3. Discuss Schematic Designations and Numerical Values

Activities:

- a. Read page 313 in Technical Electricity and Electronics.

- b. Watch a demonstration on how to identify schematic designations and numerical values.
- c. Look at circuit diagrams and try to identify schematic designations and numerical values of various components.

Materials:

Circuit diagrams

EVALUATION:

1. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
2. Look at a simple wired circuit provided by your teacher. Draw a schematic diagram of the circuit and label all necessary components. Submit the finished drawing to your instructor for evaluation.
3. Complete the attitude sheet.

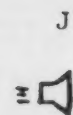
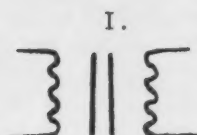
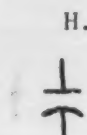
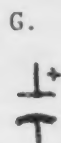
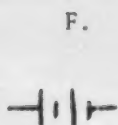
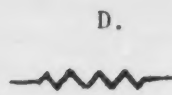
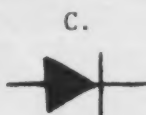
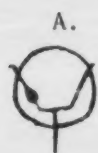
RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, New York, McGraw-Hill Book Co., 1972.



WORKSHEET

1. Identify these schematic symbols:

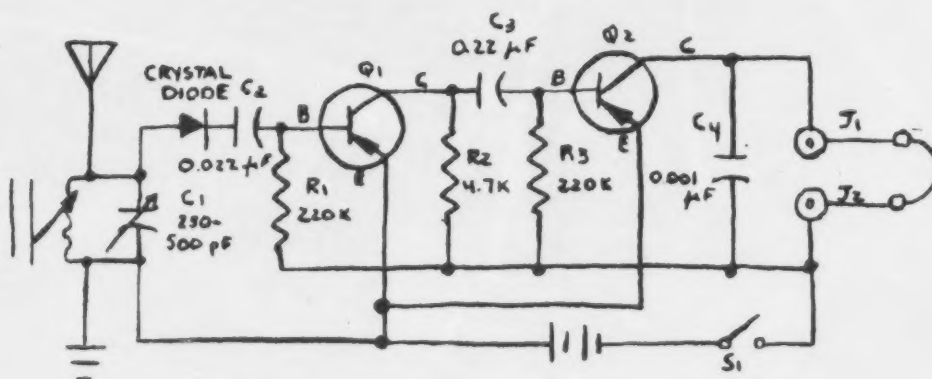


a. _____ b. _____ c. _____ d. _____ e. _____

f. _____ g. _____ h. _____ i. _____ j. _____

2. List the rules for drawing schematics.

3. Look at the schematic diagram and identify the following:



a. What component is shown at C_4 ? _____

b. What is the value of R_2 ? _____

c. At Q_1 , what does the letter B mean? _____

d. What is the value of C_1 ? _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Electrical Components by Schematic Symbol					
Learning How to Draw Schematics					
Determining Component Values from Schematic Drawings					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Measure Values in Simple Circuits

LEARNING OBJECTIVES:

1. Discuss Current Flow in a Series Resistance Circuit

Activities:

- a. Read pages 205 to 214 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a series circuit.
- c. On the worksheet, solve the problems for the series circuit.

Materials:

None

2. Discuss Current Flow in a Parallel Resistance Circuit

Activities:

- a. Read pages 229 to 242 in Basic Electricity: Theory and Practice.
- b. Watch a demonstration on current flow in a parallel circuit.
- c. On the worksheet, solve the problems for the parallel circuit.

Materials:

None

3. Discuss Current Flow in a Series-Parallel Resistance Circuit

Activities:

- a. Read pages 255 to 268 in Basic Electricity: Theory and Practice.

- b. Watch a demonstration on current flow in a series-parallel circuit.
- c. On the worksheet, solve the problems for the series-parallel circuit.
- d. Watch the movie: Series-Parallel Resistance Circuits: Circuit Analysis.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Wire the circuits found on the worksheet and measure the values with the VOM. Have your instructor check your work.
3. Complete the attitude sheet.

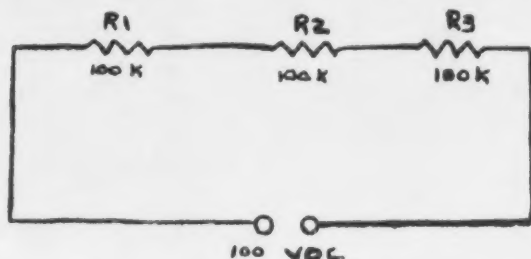
RESOURCES:

Kaufman, Milton and Wilson, J. A. Basic Electricity: Theory and Practice. New York, New York, McGraw-Hill Book Co., 1973.



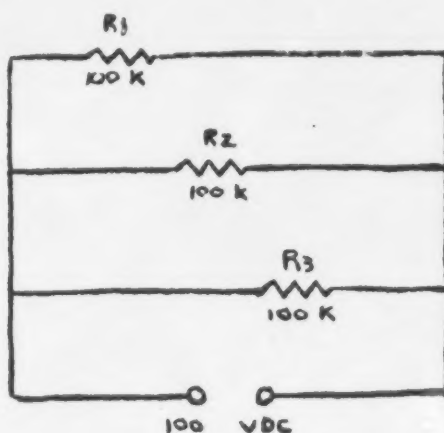
WORKSHEET

1. Solve the problems for this series circuit:



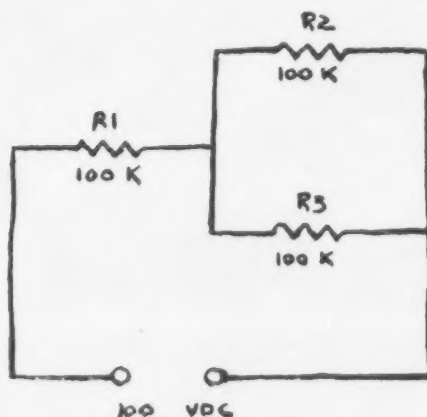
- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance at the circuit? _____

2. Solve the problems for this parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the current at R_2 ? _____
- What is the total resistance at the circuit? _____
- What is the total current flow of the circuit? _____

3. Solve the problems for this series-parallel circuit:



- What is the voltage drop at R_1 ? _____
- What is the voltage drop at R_2 ? _____
- What is the current at R_3 ? _____
- What is the total resistance of the circuit? _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Current Flow in Simple Electrical Circuits					
Wiring Electrical Circuits from Schematic Drawings					
Measuring Current Flow in Simple Electrical Circuits					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Construct a Simple Power Supply

LEARNING OBJECTIVES:

1. Tell What a Power Supply Does

Activities:

- a. Read pages 7 to 8 in Basic Electronics, Vol. 1.
- b. Watch a demonstration on what a power supply does.
- c. On the worksheet, explain what a power supply does.
- d. Watch the movie: Power Supplies, Pt. 1.

Materials:

None

2. Explain the Function of the Three Main Parts of the Power Supply: Transformer, Rectifier and Filter

Activities:

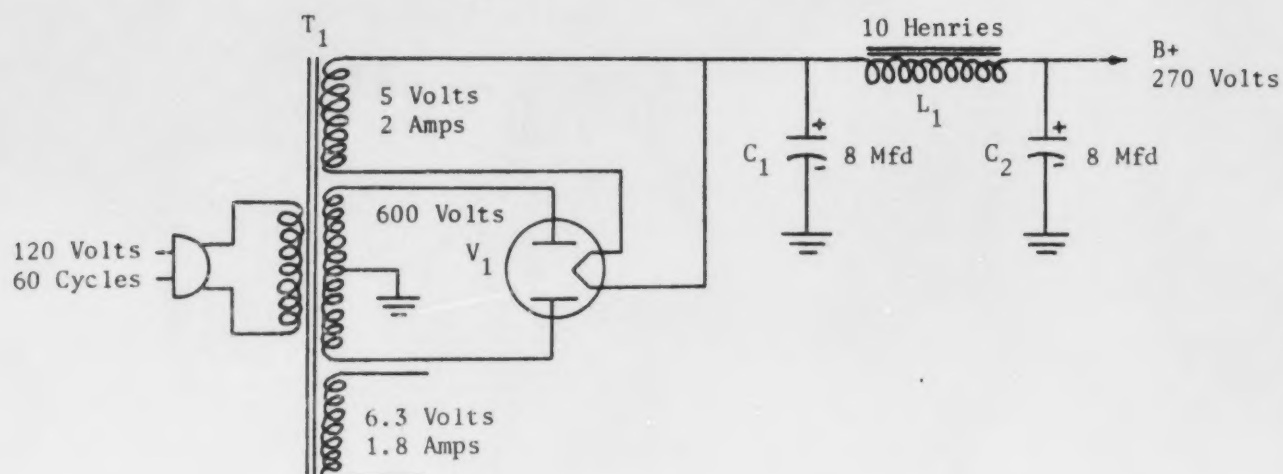
- a. Read pages 9 to 12 in Basic Electronics, Vol. 1.
- b. Watch a demonstration on the function of the transformer, rectifier and the filter in a power supply.
- c. On the worksheet, tell the function of the transformer, the rectifier and the filter.
- d. Watch the movie: Design Factors in Power Supplies.

Materials:

None

EVALUATION:

1. Using components supplied by your instructor, assemble the following power supply:

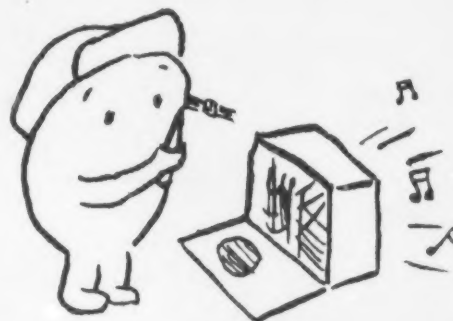


Apply a load to the power supply and measure voltage and current flow with the VOM. Examine voltage waveform at different points with the oscilloscope.

2. Complete the attitude sheet.

RESOURCES:

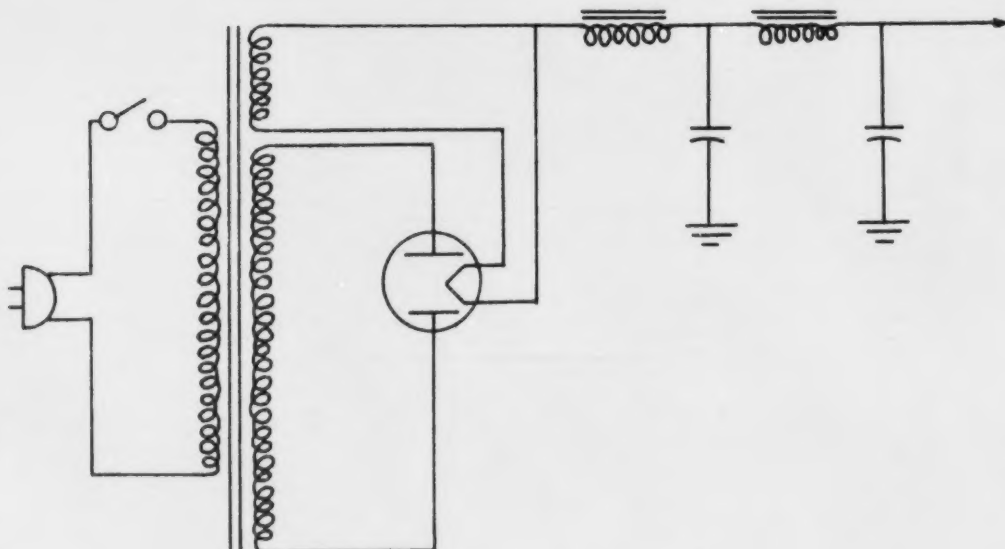
Van Valkenburgh, Nooger and Neville, Inc. Basic Electronics, Vol. 1.
New York, John F. Rider Publisher, Inc., 1954.



WORKSHEET

1. What does a power supply do?

2. In this schematic diagram, circle the transformer, the rectifier and the filter.



3. In a power supply, what is the function of the transformer, the rectifier and the filter?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Power Supply Does					
Finding Out the Job of the Parts in a Power Supply					
Wiring a Power Supply From a Schematic Drawing					
Looking at Voltage Waveforms with the Oscilloscope					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Outline the Circuits of an AM Radio

LEARNING OBJECTIVES:

1. Identify the Six Basic Circuits in the AM Radio

Activities:

- a. Read page 387 in Technical Electricity and Electronics.
- b. Watch a demonstration on the circuits of the AM radio.
- c. On the worksheet, identify the circuits of the AM radio.

Materials:

None

2. Explain the Function of Each of the Six Basic AM Radio Circuits

Activities:

- a. Read pages 387 to 390 in Technical Electricity and Electronics.
- b. Watch a demonstration on the function of the six basic circuits of the AM radio.
- c. On the worksheet, tell the function of the six basic circuits of the AM radio.
- d. Watch the movie: Basic Radio Circuitry.

Materials:

None

EVALUATION:

1. Look inside an AM radio and see if you can locate each of the six basic circuits.
2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.

3. Complete the attitude sheet.

RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, New York, McGraw-Hill Book Co., 1972.



WORKSHEET

1. Draw a block diagram of the basic circuits of the AM Radio and identify each.

2. Identify the function of the following circuits:

sensor

tuner

detector

amplifier

reproducer

power supply

3. TRUE or FALSE. The AM in radio circuitry means "Antenna modified."

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Six Basic Circuits of the AM Radio					
Seeing How the AM Radio Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Radio and TV Repairer

OCCUPATIONAL COMPETENCY: Discuss the Circuits of a Black and White Television

LEARNING OBJECTIVES:

1. Identify the Nine Basic Circuits in the Black and White Television

Activities:

- a. Read pages 419 to 424 in Technical Electricity and Electronics.
- b. Watch a demonstration on the nine basic circuits in the black and white television.
- c. On the worksheet, identify the nine basic circuits in the black and white television.
- d. Watch the movie: Television Receivers.

Materials:

None

2. Explain the Function of Each of the Nine Basic Black and White Television Circuits

Activities:

- a. Read pages 419 to 424 in Technical Electricity and Electronics.
- b. Watch a demonstration on the function of the nine basic black and white television circuits.
- c. On the worksheet, tell the function of the nine basic black and white television circuits.
- d. Watch the movie: How Television Works.

Materials:

None

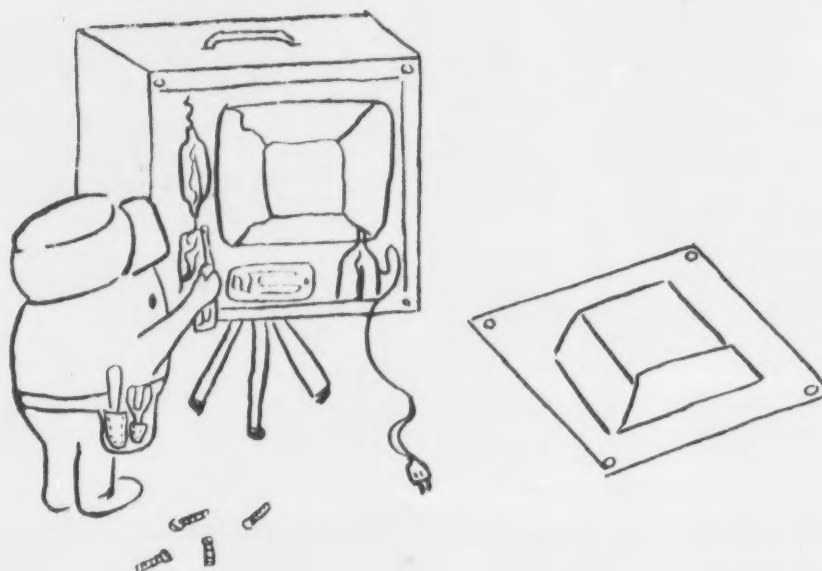
EVALUATION:

1. Look inside a black and white television and see if you can locate each of the nine basic circuits.

2. Complete the worksheet. Submit the finished worksheet to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Buban, Peter and Schmitt, Marshall. Technical Electricity and Electronics. New York, New York, McGraw-Hill Book Co., 1972.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT RADIO AND TV REPAIRER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Nine Basic Circuits of the Black and White Television					
Seeing How the Black and White Television Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

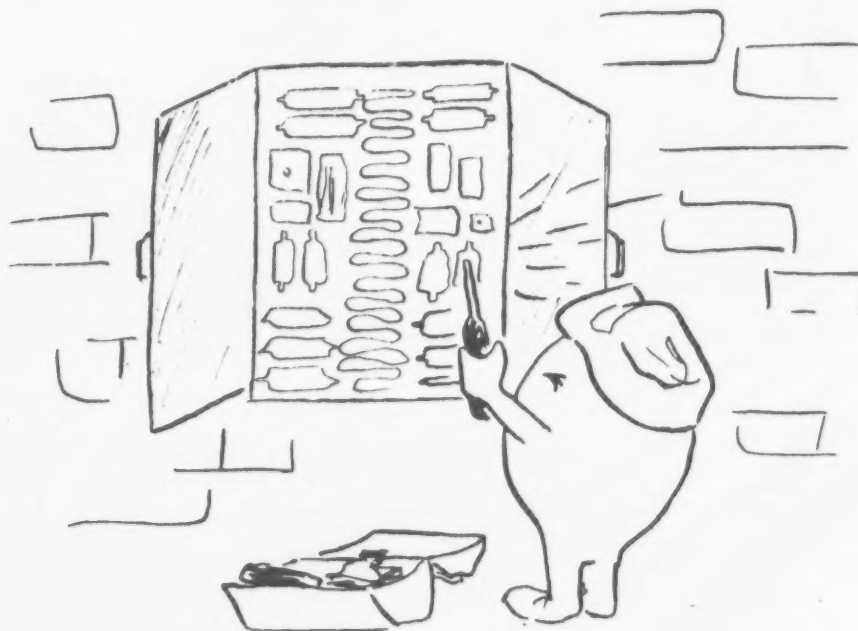
UNIT OF STUDY: Commercial Electrician

DOT OCCUPATIONAL CATEGORY: Structural Work

DOT OCCUPATIONAL DIVISION: Electrical Assembling, Installing & Repairing

DOT OCCUPATIONAL GROUP: Assembly, Installation and Repair of Lighting
Equipment and Building Wiring

OCCUPATIONAL OVERVIEW: The commercial electrician wires buildings and adjacent yards to provide electricity for power and lighting. Assembles and installs lighting equipment, conduit, switches, junction and fuse boxes and related accessories and controls. Repairs wiring and components. Inspects wiring and equipment for conformance with building and safety codes.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

824.261-010	Electrician, Wirer
824.281-014	Electric-Distribution Checker
824.281-018	Neon-Sign Servicer
824.381-010	Street-Light Servicer
824.681-010	Electrical (Mfd. Bldgs.)

653

LESSON 1

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Use the Power Law

LEARNING OBJECTIVES:

1. Define Watt

Activities:

- a. Read page 36 in Electricity and Electronics.
- b. Watch a demonstration on power and wattage rating.
- c. On the worksheet, define watt.

Materials:

None

2. Use the Power Law

Activities:

- a. Read page 36 in Electricity and Electronics.
- b. Watch a demonstration explaining the Power Law.
- c. On the worksheet, solve problems using the Power Law.

Materials:

None

3. Identify the Power Usage of Common Devices

Activities:

- a. Read page 37 in Electricity and Electronics.
- b. Watch a demonstration on the power usage of common electrical devices.
- c. Look at an assortment of electrical devices and identify power ratings of each.

Materials:

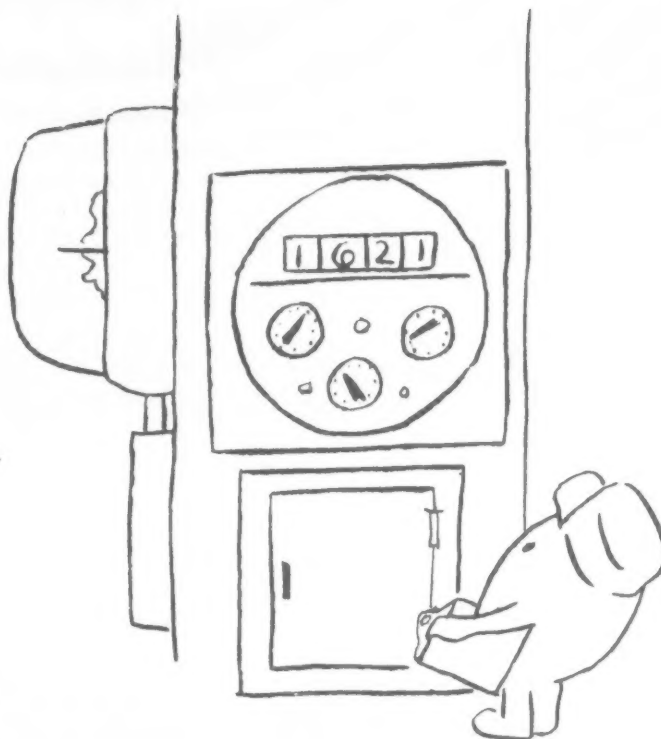
Assortment of electrical devices

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Williams, Gerald E. Electricity and Electronics. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. Define Watt.
2. State the Power Law.
3. Using the Power Law, solve the following problems:
 - a. How much current is used by a light rated at 12 volts and 20 watts?
 - b. How much power is used by a radio rated at 120 volts and .1 amperes of current?
 - c. What is the voltage rating of a toaster if it consumes 1200 watts of power and uses 10 amperes of current?
4. TRUE or FALSE. A kilowatt is 100 watts.
5. TRUE or FALSE. It would be cheaper to listen to a 10 watt radio for one hour than to listen to a 50 watt stereo tape player for fifteen minutes.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Watt Is					
Learning the Power Law					
Solving Problems With the Power Law					
Identifying Power Usage of Electric Devices					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Discuss Electrical Wires

LEARNING OBJECTIVES:

1. Discuss Current Ratings of Various Gage Wires

Activities:

- a. Read pages 49 to 54 in Electrical Wiring.
- b. Watch a demonstration on the current ratings of the various gage wires.
- c. On the worksheet, tell the relationship between wire size and voltage drop.
- d. On the worksheet, explain the sizes of wire.
- e. Use a wire gage to check wire sizes.

Materials:

Assortment of wire sizes, wire gage

2. Tell About the Uses of Insulation on Electrical Wires

Activities:

- a. Read pages 54 to 57 in Electrical Wiring.
- b. Watch a demonstration on the uses of insulation on electrical wires.
- c. From an assortment of insulated house wires, identify the type of insulation and tell about its use.

Materials:

Assortment of insulated house wires

3. Tell About the Function of Conduit

Activities:

- a. Read page 25 in Basic Wiring.
- b. Watch a demonstration showing the uses of conduit and flexible cable.
- c. On the worksheet, name three types of rigid conduit.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.

WORKSHEET

1. Tell the relationship between wire size and voltage drop.

2. Explain the sizes of wires.

3. TRUE or FALSE. A No. 10 wire has a higher current rating than a No. 12 wire.
4. TRUE or FALSE. As long as a wire is insulated, it can be used anywhere in the house.
5. Name three types of rigid conduit.

6. List five types of indoor wire insulation and tell about their use.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning Current Ratings of Various Gage Wires					
Knowing the Uses of Wire Insulation					
Finding Out How to Use Conduit					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Discuss Electrical Circuit Layout

LEARNING OBJECTIVES:

1. List Some General Considerations in Electrical Circuit Layout

Activities:

- a. Read pages 123 to 126 in Electrical Wiring.
- b. Watch a demonstration on considerations in electrical circuit layout.
- c. Watch the movie: Electricity - Distribution.

Materials:

None

2. Discuss Electrical Service Needs and Layout for Selected Rooms in the House

Activities:

- a. Read pages 126 to 136 in Electrical Wiring.
- b. Watch a demonstration on electrical service needs and layout for selected rooms in the house.
- c. On the worksheet, explain the electrical service needs and layout for your bedroom.
- d. Watch the movie: Roughing-In Nonmetallic Sheathed Cable.
- e. Watch the movie: Electricity - Wires in Your Home.

Materials:

None

3. Identify Electrical Schematic Symbols for Wiring Plans

Activities:

- a. Read page 143, Table 6-1, in Electrical Wiring.
- b. Watch a demonstration on the identification of electrical schematic symbols.
- c. On the worksheet, identify some electrical schematic symbols.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.



WORKSHEET

1. In the space provided, identify and layout the electrical service needs for your bedroom at home.

2. TRUE or FALSE. All closets should have an overhead light.

3. Identify the following schematic symbols:



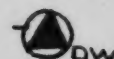
a. _____



b. _____



c. _____



d. _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Layout Electric Circuits					
Identifying Electric Service Needs For a Given Room in a House					
Identifying Electrical Schematic Symbols					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Wire a Single-Pole Switch

LEARNING OBJECTIVES:

1. Identify the Four Basic Types of Switches

Activities:

- a. Read page 40 in Basic Wiring.
- b. Watch a demonstration identifying the four basic types of switches.
- c. On the worksheet, tell what each of the four basic types of switches is used for.
- d. From an assortment of switches, identify each type.
- e. Watch a movie: At Home With Switches.

Materials:

Assortment of Switches

2. Outline How to Choose a Switch of the Proper Rating

Activities:

- a. Read page 41 in Basic Wiring.
- b. Watch a demonstration on how to choose a switch by its rating.
- c. Look at a switch and tell what its ratings are.

Materials:

Switch

3. Wire a Light With a Single-Pole Switch

Activities:

- a. Read pages 220 to 221 in Electrical Wiring.

- b. Read pages 43 to 44 in Basic Wiring.
- c. Watch a demonstration on how to wire a light to a single-pole switch.
- d. Practice wiring a light to a single-pole switch.

Materials:

Light bulb, light bulb socket, wire, single-pole switch, screw driver, insulation stripper, AC line cord

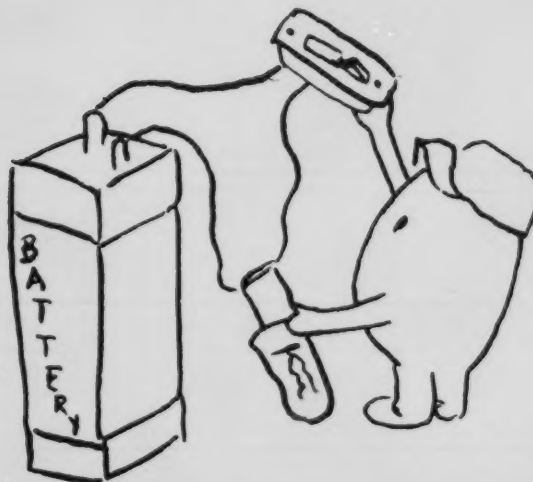
EVALUATION:

1. At the work bench, wire a light bulb to a single-pole switch. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

Herrick, Clyde N. Electrical Wiring Principles and Practices. Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.



WORKSHEET

1. Tell what each of the four basic types of switches are used for.

2. Identify these switches:

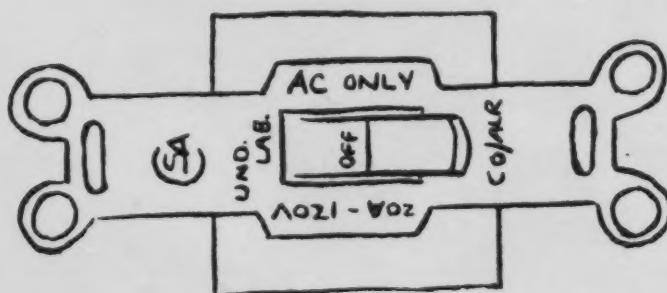


a. _____



b. _____

3. Tell the ratings of this switch.



Max. current _____

Voltage _____

Wire type _____

AC or DC _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out About the Different Types of Switches					
Determining the Rating of a Switch					
Wiring a Light to a Single Pole Switch					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Wire a Three-Way Switch

LEARNING OBJECTIVES:

1. Tell About Specialized Switches

Activities:

- a. Read page 42 in Basic Wiring.
- b. Watch a demonstration on specialized switches.
- c. On the worksheet, tell where you would use certain specialized switches.

Materials:

None

2. Wire a Three-Way Switch

Activities:

- a. Read pages 227 to 230 in Electrical Wiring.
- b. Read page 46 in Basic Wiring.
- c. Watch a demonstration on how to wire a three-way switch system.
- d. Practice wiring a light to a set of three-way switches.

Materials:

Light bulb, light bulb socket, pair of three-way switches, wire, screw driver, insulation stripper, AC line cord

EVALUATION:

1. At the work bench, wire a light bulb between a pair of three-way switches. Have your instructor check your work.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

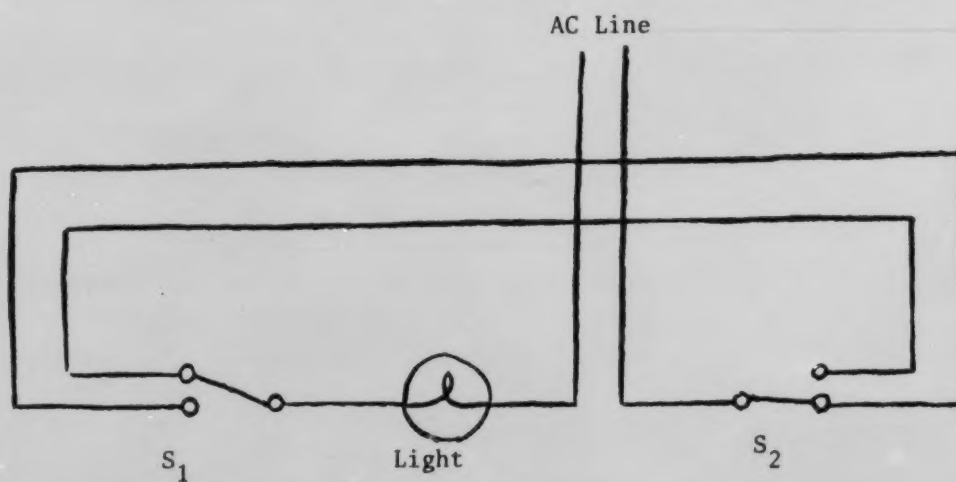
Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.

WORKSHEET

1. Tell where you would use the following specialized switches:

- a. Mercury Switch
- b. Dimmer Switch
- c. Time-Delay Switch
- d. Pilot-Light Switch

2. TRUE or FALSE. The following three-way switch wiring diagram is acceptable.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Special Switches					
Wiring a Light to a Pair of Three-Way Switches					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Wire an Electric Receptacle

LEARNING OBJECTIVES:

1. Identify the Two Kinds of Electric Receptacles

Activities:

- a. Read page 53 in Basic Wiring.
- b. Watch a demonstration on the two kinds of electric receptacles.
- c. From an assortment of receptacles, identify each by type.

Materials:

Assortment of receptacles

2. Read the Ratings of a Receptacle

Activities:

- a. Read page 53 in Basic Wiring.
- b. Watch a demonstration on how to identify the ratings of an electric receptacle.
- c. From an assortment of receptacles, identify each type of receptacle and its rating.

Materials:

Assortment of receptacles

3. Wire a Receptacle

Activities:

- a. Read pages 54 to 55 in Basic Wiring.
- b. Watch a demonstration on how to wire a receptacle.
- c. Practice wiring a receptacle.

Materials:

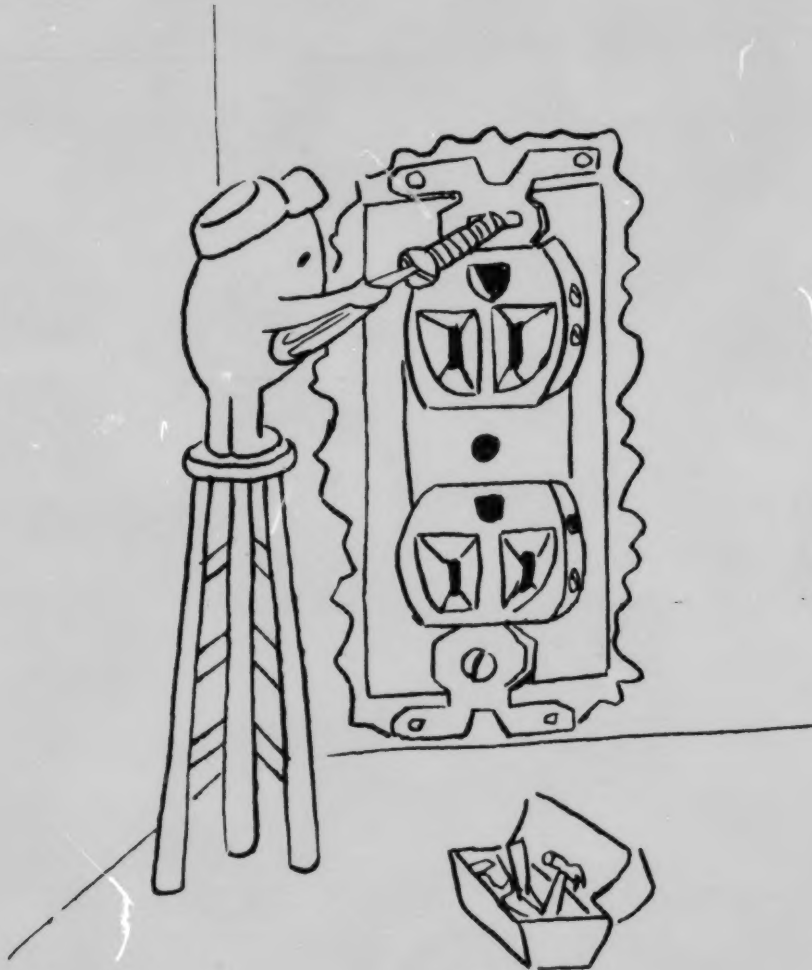
Receptacle, wire, screw driver, insulation stripper, AC line cord

EVALUATION:

1. At the work bench, wire a receptacle. Plug an electrical device into the receptacle to test proper hook-up. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

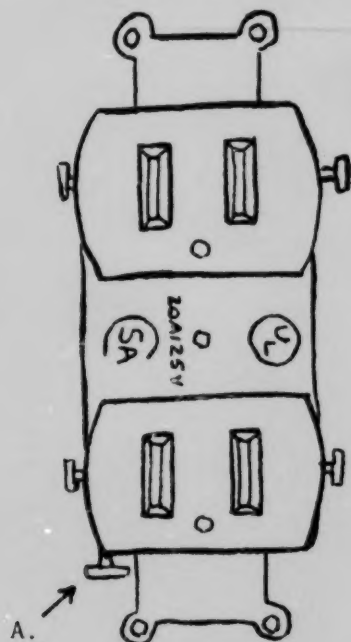
RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.



WORKSHEET

1. Identify the following type of receptacle and its ratings:



a. type _____

b. current _____

c. voltage _____

d. wire type _____

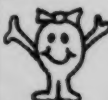
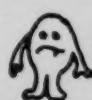
2. Tell what the terminal screw is used for located at "A" in the above drawing.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Types of Electric Receptacles					
Determining the Ratings of a Receptacle					
Wiring a Receptacle					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Install a Fluorescent Light

LEARNING OBJECTIVES:

1. Tell About the Variety of Fluorescent Tubes

Activities:

- a. Read page 36 in Basic Wiring.
- b. Watch a demonstration on the variety of fluorescent tubes.
- c. From an assortment of fluorescent tubes, identify each type and its characteristics.

Materials:

Assortment of fluorescent tubes

2. Identify the Three Types of Fluorescent Light Fixtures

Activities:

- a. Read page 38 in Basic Wiring.
- b. Watch a demonstration on the three types of fluorescent light fixtures.
- c. From an assortment of fluorescent light fixtures, identify each type.
- d. On the worksheet, tell where each type of fixture might be found.

Materials:

None

3. Identify the Parts of a Fluorescent Light Fixture

Activities:

- a. Read pages 36 to 38 in Basic Wiring.

- b. Watch a demonstration on the parts of a fluorescent light fixture.
- c. On the worksheet, identify the parts of a rapid start type fixture.

Materials:

None

4. Discuss Trouble-Shooting Procedures for Fluorescent Fixtures

Activities:

- a. Read page 39 in Basic Wiring.
- b. Watch a demonstration on trouble-shooting fluorescent fixtures.
- c. On the worksheet, tell what causes certain problems in fluorescent fixtures.

Materials:

None

5. Wire a Fluorescent Fixture

Activities:

- a. Read page 37 in Basic Wiring.
- b. Watch a demonstration on how to wire a fluorescent fixture.
- c. Watch a demonstration on how to insert a fluorescent lamp into a fixture.
- d. Practice wiring a fluorescent lamp.

Materials:

Fluorescent lamp, fixture, wire, insulation stripper,
AC line cord, single-pole switch

EVALUATION:

1. At the work bench, wire a fluorescent light fixture to a single-pole switch. Have the instructor check your work.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

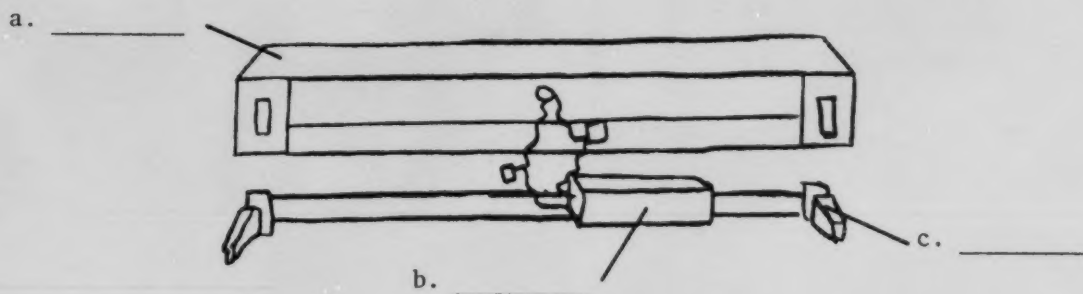


WORKSHEET

1. Tell where each type of fluorescent light fixtures might be found.

2. TRUE or FALSE. If a fluorescent tube has markings of F15T8/CW, then it is a cool white 15 watt tube.

3. Identify the parts of the following rapid start fixture:



4. Tell what the possible causes are for the following problems in fluorescent fixtures:

- a. tube will not light
- b. fixture hums
- c. blackening at ends of tube

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Types of Electric Receptacles					
Seeing the Different Kinds of Fluorescent Tubes					
Knowing How to Trouble-Shoot a Fluorescent Fixture					
Wiring a Fluorescent Light Fixture					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Discuss Fuses and Circuit Breakers

LEARNING OBJECTIVES:

1. Identify Four Types of Fuses

Activities:

- a. Read page 16 in Basic Wiring.
- b. Watch a demonstration on the four types of fuses.
- c. From an assortment of fuses, identify each type.
- d. Watch the movie: Electricity - Principles of Safety.

Materials:

Assortment of Fuses

2. Discuss the Use and Ratings of Fuses

Activities:

- a. Read pages 16 to 17 in Basic Wiring.
- b. Watch a demonstration on the use and ratings of fuses.
- c. From an assortment of fuses, identify the rating and use of each.

Materials:

Assortment of fuses

3. Tell How a Circuit Breaker Operates

Activities:

- a. Read pages 79 to 84 in Electrical Wiring.
- b. Watch a demonstration on the use and operation of a circuit breaker.
- c. On the worksheet, tell how a circuit breaker operates.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.



WORKSHEET

1. Identify the type, rating and use of the following fuse.



a. Type: _____

b. Rating: _____

c. Use: _____

2. Tell how a circuit breaker operates.

3. Tell why it is best to have a motor wired to a circuit breaker than a plug-type fuse.

4. TRUE or FALSE. A time-delay fuse will allow you enough time to vacate a building incase of an electrical short circuit.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Different Types of Fuses					
Identifying the Ratings of Fuses					
Knowing How a Circuit Breaker Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Describe the Installation of Ground Wiring

LEARNING OBJECTIVES:

1. Tell About the Importance of an Electrical Grounding

Activities:

- a. Read pages 84 to 86 in Electrical Wiring.
- b. Watch a demonstration on the importance of electrical grounding.
- c. On the worksheet, explain the importance of grounding.

Materials:

None

2. Explain How a Ground Rod Is Installed

Activities:

- a. Read pages 87 to 88 in Electrical Wiring.
- b. Watch a demonstration on how a ground rod is installed at the home.
- c. On the worksheet, tell how to install a ground rod.

Materials:

None

3. Explain How a Switch and a Receptacle Are Grounded When Being Installed

Activities:

- a. Read pages 43 to 44 and 54 to 55 in Basic Wiring.
- b. Watch a demonstration on how to ground a switch and a receptacle.
- c. Practice wiring a single-pole switch with a ground wire.

Materials:

Three-conductor wire, single-pole switch, switch box, screw driver, insulation stripper, wire nuts

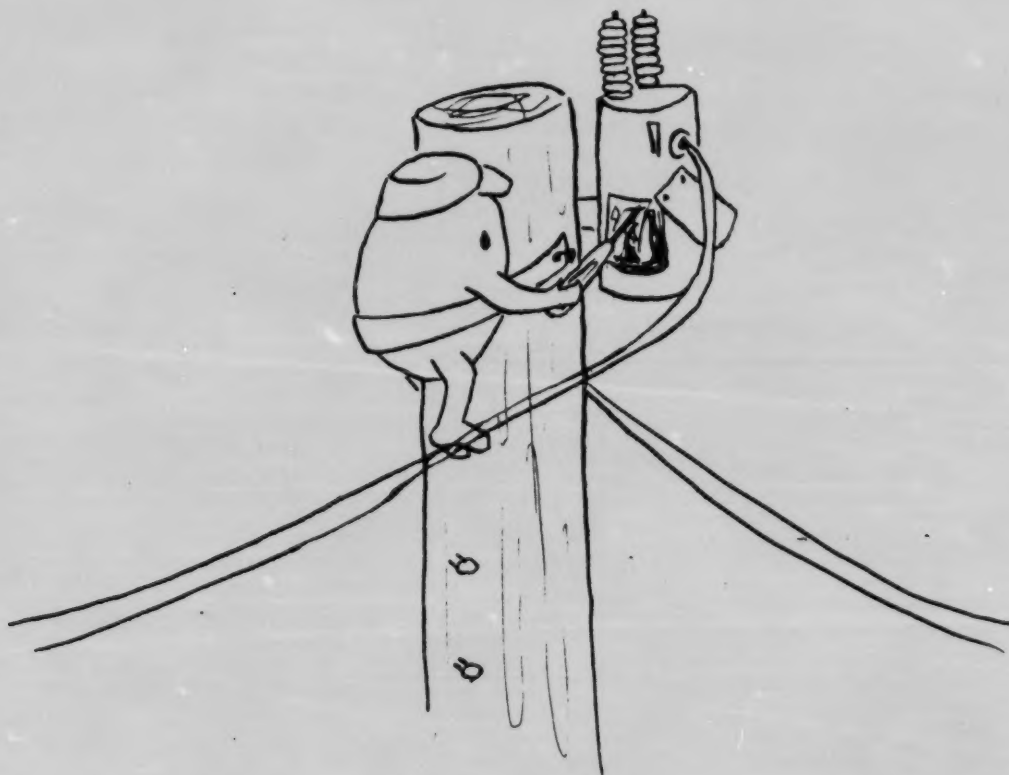
EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.



WORKSHEET

1. Why is it important to have electrical circuits grounded?
2. Tell how to install a ground rod.
3. Draw sketches showing how to ground a single-pole switch and a receptacle when they are being wired.

2. Tell how to install a ground rod.

3. Draw sketches showing how to ground a single-pole switch and a receptacle when they are being wired.

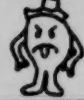
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STUDENT ATTITUDE SHEET

for

CLUSTER _____ MANUFACTURING _____ UNIT _____ COMMERCIAL ELECTRICIAN _____

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out About the Importance of Electrical Grounding					
Learning How a Ground Rod is Installed					
Seeing How Switches and Receptacles Are Grounded					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Commercial Electrician

OCCUPATIONAL COMPETENCY: Discuss Outdoor Electrical Wiring

LEARNING OBJECTIVES:

1. Name the Weatherproof Fixtures Used in Outdoor Wiring

Activities:

- a. Read pages 112 to 113 in Basic Wiring.
- b. Watch a demonstration on the weatherproof fixtures used in outdoor wiring.
- c. From an assortment of weatherproof fixtures, identify each one and tell about its use.

Materials:

Assortment of weatherproof fixtures

2. Tell How to Run Wires Underground to an Outlying Receptacle

Activities:

- a. Read pages 114 to 115, 118 to 119 and 122 in Basic Wiring.
- b. Watch a demonstration on running underground wires.
- c. Practice working with scrap heavy-wall conduit.

Materials:

Scrap heavy-wall conduit, conduit bender, conduit components, screw driver, wrench

EVALUATION:

1. Wire a receptacle as though it were outside. Run wires through a 10 foot section of $\frac{1}{2}$ " conduit and attach all bushings, receptacles and other accessories as necessary. Have the instructor check your work.

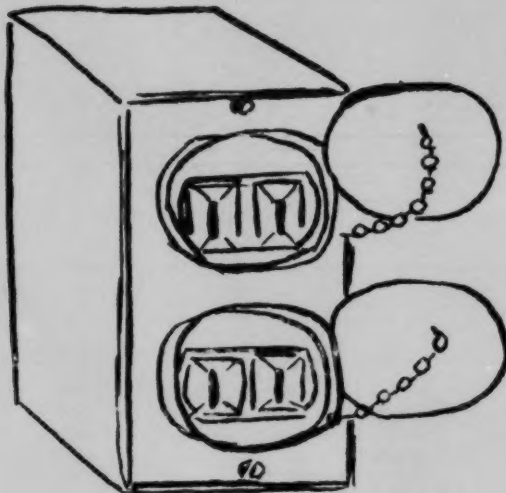
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

WORKSHEET

1. Identify this fixture and describe its use:



2. TRUE or FALSE. Any type of insulated wire can be used outdoors as long as it is in conduit.
3. Explain the purpose of the gasket in weatherproof fixtures.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COMMERCIAL ELECTRICIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying Weatherproof Electrical Fixtures					
Running Underground Electrical Wiring					
QUESTIONS	YES.	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

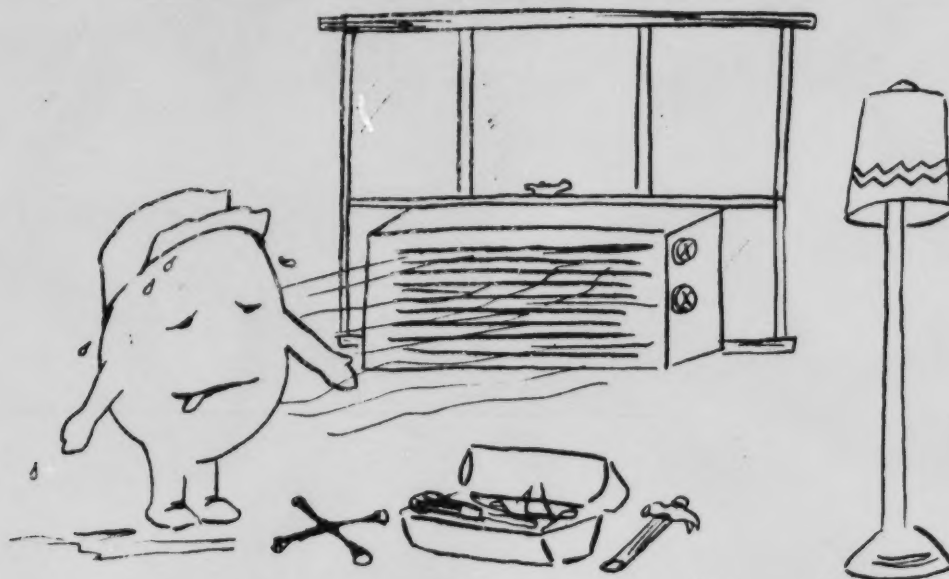
UNIT OF STUDY: Air Conditioner Mechanic

DOT OCCUPATIONAL CATEGORY: Machine Trades

DOT OCCUPATIONAL DIVISION: Mechanics

DOT OCCUPATIONAL GROUP: Utilities Service Mechanics and Repairers

OCCUPATIONAL OVERVIEW: The air conditioner mechanic installs, services, and repairs air conditioning units in residences, department stores, office buildings and commercial establishments. Mounts compressors, installs tubing and electrical controls, installs evaporator units and tests systems for operation. Replaces filters, lubricates units, and adjusts controls.



REPRESENTATIVES JOB TITLES WITH DOT CODES:

637.261-010 Air Conditioner Installer-Servicer, Window Unit
637.261-014 Air Conditioning Mechanic, Industrial
637.664-010 Environmental-Control-System Installer-Servicer
007.181-010 Air Conditioning Technician
827.464-010 Air Conditioning Installer, Domestic
827.361-010 Air Conditioning-Unit Tester

LESSON 1

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Discuss Air Conditioning Fundamentals

LEARNING OBJECTIVES:

1. Discuss the Properties of Air

Activities:

- a. Read pages 10 to 12 in Air Conditioning.
- b. Watch a demonstration on the properties of air.
- c. Tell what gas is given off by most plants.
- d. Explain why the air smells fresh after a lightning storm.
- e. Watch the movie: Let's Talk About Air.

Materials:

None

2. Define Sensible Heat, Specific Heat, Latent Heat, and Super Heat

Activities:

- a. Read pages 12 to 15 in Air Conditioning.
- b. Watch a demonstration on sensible heat, specific heat, latent heat, and super heat.
- c. Think of some materials which are liquid, some which are solid, and some which are gas.
- d. Define sensible heat, specific heat, latent heat, and super heat.

Materials:

None

3. Tell How Pressure and Temperature Are Related

Activities:

- a. Read pages 15 to 17 in Air Conditioning.
- b. Watch a demonstration on the relation of pressure and temperature on gas.
- c. State the "Combined Law of Boyle and Charles".
- d. Define critical temperature and critical pressure.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Anderson, Edwin P. Air Conditioning. Indianapolis, Indiana,
Theodore Audel & Co., 1971.

WORKSHEET

1. What gases make up air?

2. Why is air movement an important part of air conditioning?

3. What things can be used to clean and filter air?

4. TRUE or FALSE. Specific heat is measured with a thermometer.
5. TRUE or FALSE. Latent heat causes a material to change from solid to liquid.
6. State Boyle's Law. Explain what it means.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Properties of Air					
Learning About Heat					
Seeing How Temperature and Pressure Are Related					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Measure Temperature

LEARNING OBJECTIVES:

1. Define BTU

Activities:

- a. Read pages 8 to 9 in Environment Control.
- b. Read page 21 in Air Conditioning.
- c. Watch a demonstration on BTU.
- d. Describe how much heat is in one BTU.
- e. Watch the movie: Heat and Temperature.

Materials:

None

2. Tell How to Measure Heat, Atmospheric Pressure and Relative Humidity

Activities:

- a. Read pages 17 to 20 in Air Conditioning.
- b. Watch a demonstration on how heat, atmospheric pressure and relative humidity are measured.
- c. Explain how a sling psychrometer works.
- d. Explain how a thermometer works.

Materials:

None

3. Use Fahrenheit and Centigrade Scales to Measure Temperature

Activities:

- a. Read pages 17 to 18 in Air Conditioning.

b. Watch a demonstration on reading Fahrenheit and Centigrade scales.

c. Write the formulas to convert:

Fahrenheit to Centigrade
Centigrade to Fahrenheit

d. Practice reading temperature with both thermometer scales.

e. Practice converting Fahrenheit to Centigrade and Centigrade to Fahrenheit.

Materials:

Fahrenheit thermometer, Centigrade thermometer, pencil, paper

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Using a Fahrenheit thermometer, measure the temperature of several items provided by your instructor. Convert each of these readings to Centigrade. Next, measure several other items on the Centigrade scale and convert them to Fahrenheit. Have the instructor check your work.
3. Complete the attitude sheet.

RESOURCES:

Anderson, Edwin P. Air Conditioning. Indianapolis, Indiana, Theodore Audel & Co., 1971.

Weaver, Michael K. and Kirkpatrick, James M. Environment Control. New York, Harper & Row, Publishers, 1974.

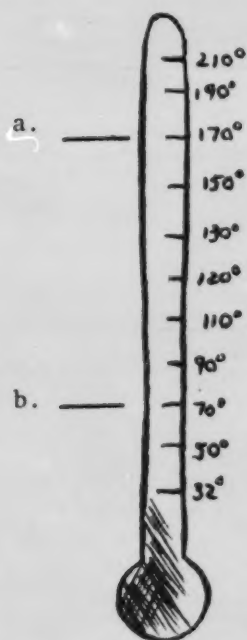


WORKSHEET

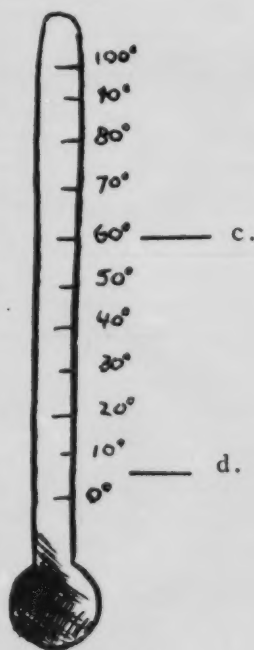
1. Define BTU.

2. TRUE or FALSE. Temperature is measured by the height of silver in a thermometer stem.

3. Read the following temperatures:



Centigrade



Fahrenheit

a. _____

b. _____

a. _____

b. _____

c. _____

d. _____

4. Convert the following temperatures:

a. 10 C = _____ F

b. 45 C = _____ F

c. 32 F = _____ C

d. 77 F = _____ C

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing What BTU Is					
Learning How to Measure Heat, Pressure and Humidity					
Converting Fahrenheit to Centigrade					
Measuring Temperature					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Describe Heat Transfer

LEARNING OBJECTIVES:

1. Describe Three Methods of Heat Transfer

Activities:

- a. Read pages 27 to 28 in Environment Control.
- b. Watch a demonstration on the three methods of heat transfer.
- c. On the worksheet, tell where each method of heat transfer is found.
- d. Tell why a dark colored object is hotter than a light colored object on a summer day.
- e. Watch the movie: Principles of Refrigeration.

Materials:

None

2. Tell How to Control Heat Transfer

Activities:

- a. Read page 28 in Environment Control.
- b. Watch a demonstration on how to control heat transfer.
- c. On the worksheet, tell how to control each of the three methods of heat transfer.

Materials:

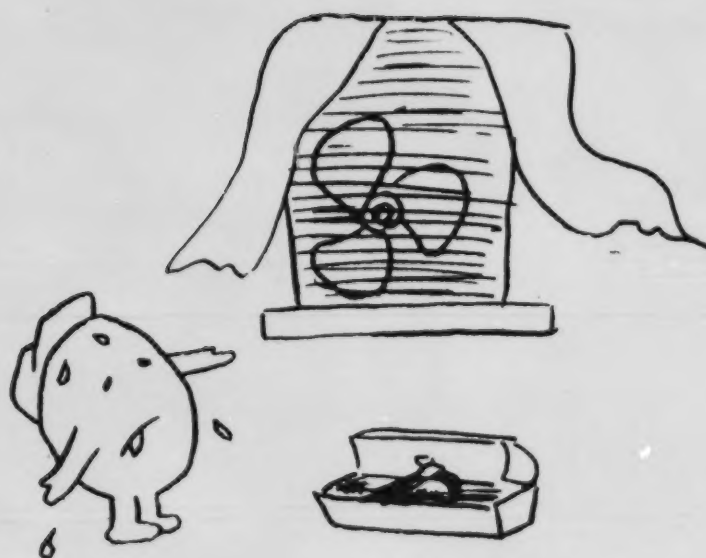
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.



WORKSHEET

1. Tell where each method of heat transfer is found.

2. MULTIPLE CHOICE. The earth receives heat from the sun by: (a) radiation
(b) conduction (c) convection (d) reflection
3. MULTIPLE CHOICE. A pot-bellied stove heats by: (a) reflection (b) radiation
(c) convection (d) conduction
4. TRUE or FALSE. Forced - air heating systems transfer heat using the convection principle.
5. Describe how to control each of the three methods of heat transfer.

6. Since the earth is heated directly by the sun, why isn't the air in the atmosphere hot?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Describing Three Methods of Heat Transfer					
Telling How to Control Heat Transfer					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Tell How to Measure Pressure

LEARNING OBJECTIVES:

1. Define Pressure

Activities:

- a. Read page 30 in Environment Control.
- b. Watch a demonstration on atmospheric pressure.
- c. On the worksheet, define atmospheric pressure.
- d. Tell how much atmospheric pressure exists at sea level.
- e. Watch the movie: Pressure and Humidity.

Materials:

None

2. Compare Gauge Pressure to Absolute Pressure

Activities:

- a. Read pages 30 to 31 in Environment Control.
- b. Watch a demonstration comparing gauge pressure to absolute pressure.
- c. Explain what a vacuum is.
- d. On the worksheet, tell how a gauge pressure of 0 compares to an absolute pressure of 0.

Materials:

None

3. Measure Pressure

Activities:

- a. Read pages 31 to 33 in Environment Control.

- b. Watch a demonstration on how to measure pressure.
- c. On the worksheet, name some instruments for measuring pressure.
- d. Practice taking a pressure reading with a barometer.

Materials:

Barometer

EVALUATION:

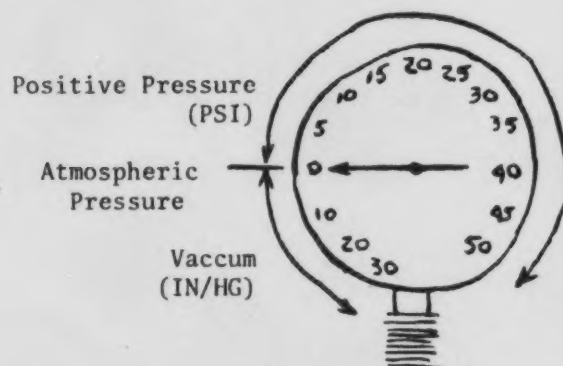
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Use a barometer and measure the barometric pressure in your room. Have your instructor check your work.
3. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.

WORKSHEET

1. Define atmospheric pressure.
2. Give three examples of pressure gauges.
3. TRUE or FALSE. The pressure of three inches of water on the sides of a glass is the same as the pressure of five inches of water.
4. Identify this gauge:



5. TRUE or FALSE. Gas pressure changes with temperature.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Pressure					
Comparing Gauge Pressure to Absolute Pressure					
Measuring Pressure					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Outline a Basic Compression Refrigeration System

LEARNING OBJECTIVES:

1. Tell How Evaporative Cooling Works

Activities:

- a. Read pages 42 to 43 in Environment Control.
- b. Watch a demonstration on evaporative cooling.
- c. On the worksheet, explain how evaporative cooling works.
- d. Define "saturation point".
- e. Watch the movie: Refrigeration and Air Conditioning.

Materials:

None

2. List and Describe the Components of a Basic Compression Refrigeration System

Activities:

- a. Read pages 45 to 46 in Environment Control.
- b. Watch a demonstration on the components in a basic compression refrigeration system.
- c. On the worksheet, draw a diagram of the basic compression refrigeration system and identify the parts.
- d. Watch the movie: Refrigeration - Principles of Mechanical Refrigeration.

Materials:

None

3. Explain How the Basic Compression Refrigeration System Operates

Activities:

- a. Read pages 46 to 47 in Environment Control.
- b. Watch a demonstration on how the basic compression refrigeration system operates.
- c. On the worksheet, explain how the basic compression refrigeration system operates.
- d. Define "high side" and "low side".

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.



WORKSHEET

1. Explain how evaporative cooling works.
2. Draw a diagram of the basic compression refrigeration system, identify the parts and tell how it operates.

3. TRUE or FALSE. The refrigerant gives up its absorbed heat in the capillary tube section.
4. TRUE or FALSE. The refrigerant exists as a solid, a liquid and as a gas while in the air conditioner.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing What Evaporative Cooling Is					
Seeing How Evaporative Cooling Works					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Discuss Refrigerants

LEARNING OBJECTIVES:

1. Define Refrigerant

Activities:

- a. Read page 49 in Environment Control.
- b. Watch a demonstration on refrigerants used in refrigeration systems.
- c. On the worksheet, tell what the refrigerant does in the refrigeration system.

Materials:

None

2. Identify Five Common Refrigerants

Activities:

- a. Read page 50, Table 11-1 in Environment Control.
- b. Watch a demonstration on the various refrigerants used in refrigeration systems.
- c. On the worksheet, name five common refrigerants.

Materials:

None

3. Discuss Thermodynamic and Material Properties of Refrigerants

Activities:

- a. Read pages 49 to 55 in Environment Control.
- b. Watch a demonstration on thermodynamic and material properties of refrigerants.

- c. On the worksheet, list the thermodynamic and material properties to be considered in selecting a refrigerant.
- d. For a given property, discuss which refrigerants are best and which are worst.

Materials:

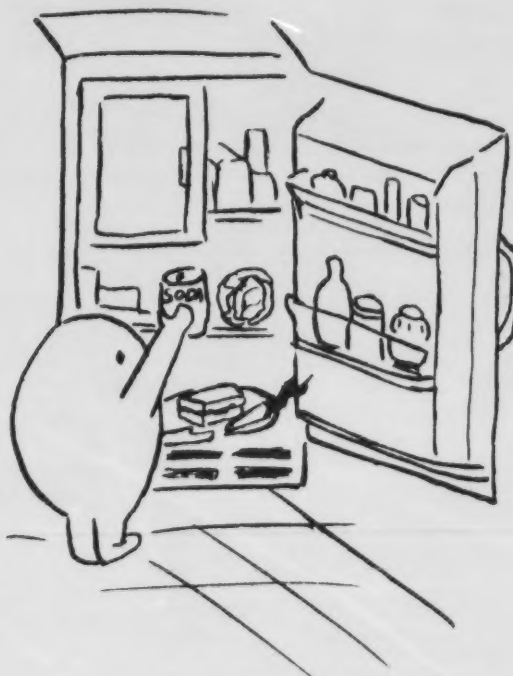
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.



WORKSHEET

1. Tell what the refrigerant does in the refrigeration system.
2. Name five common refrigerants.
3. List the thermodynamic and material properties of refrigerants and tell why they are important.
4. If the compressor of an air conditioner was very weak and not capable of high compression, which refrigerant would you select for use? Why?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Refrigerants					
Knowing Five Common Refrigerants					
Learning About the Properties of Refrigerants					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Describe Compressors

LEARNING OBJECTIVES:

1. Explain the Function of the Compressor in the Refrigerator System

Activities:

- a. Read page 68 in Environment Control.
- b. Watch a demonstration on the function of the compressor in the refrigeration system.
- c. On the worksheet, explain the function of the compressor in the refrigeration system.
- d. Define "compressor efficiency".
- e. Watch the movie: Refrigeration - Compressor Controls.

Materials:

None

2. Name the Three Basic Compressor Types

Activities:

- a. Read page 71 in Environment Control.
- b. Watch a demonstration on the three basic compressor types.
- c. On the worksheet, name the three basic compressor types.

Materials:

None

3. Describe the Operation of the Reciprocating and Rotary Compressors

Activities:

- a. Read pages 71 to 75 in Environment Control.
- b. Watch a demonstration on how the reciprocating and the rotary compressor operates.
- c. Name the two types of rotary compressors.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

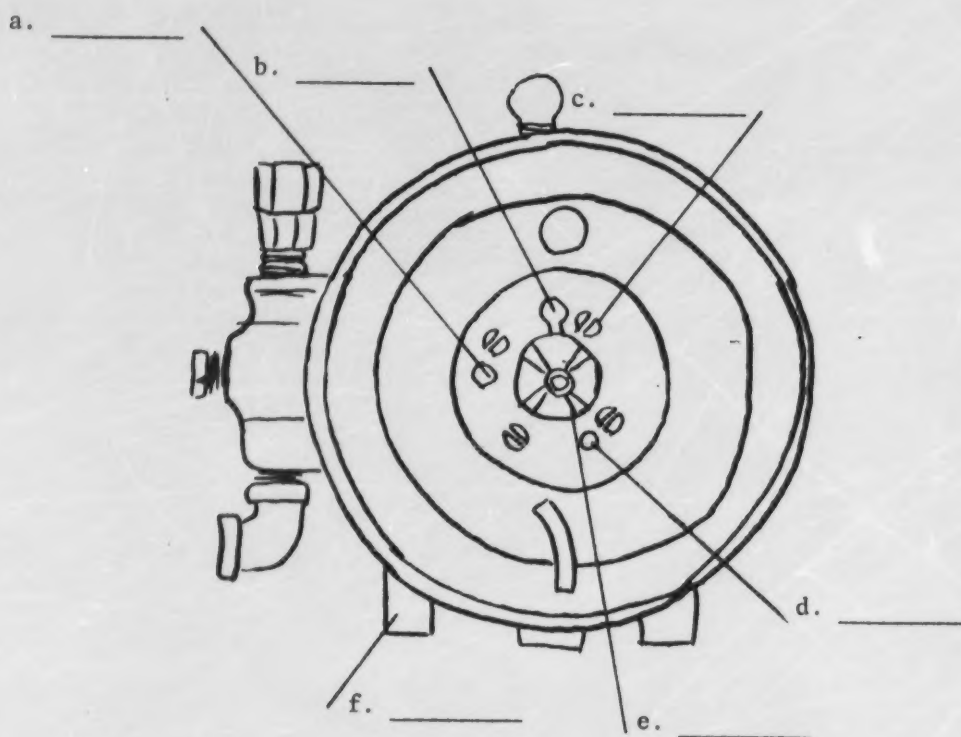
Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.

WORKSHEET

1. Tell what the compressor does in the refrigeration system.

2. Name the three basic compressor types.

3. Identify the parts of the Rotary Compressor:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Telling About the Role of the Compressor In the Refrigerator System					
Learning About the Three Types of Compressors					
Knowing How Compressors Operate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Describe Evaporators

LEARNING OBJECTIVES:

1. Describe the Evaporators' Role in the Refrigeration System

Activities:

- a. Read pages 88 to 89 in Environment Control.
- b. Watch a demonstration on what an evaporator does in the refrigeration system.
- c. On the worksheet, describe the role of the evaporator in the refrigeration system.
- d. Watch the movie: Refrigeration - Evaporator Controls.

Materials:

None

2. Name and Describe the Two Types of Evaporators

Activities:

- a. Read page 89 in Environment Control.
- b. Watch a demonstration on the two types of evaporators.
- c. On the worksheet, identify the two types of evaporators used in refrigeration systems.

Materials:

None

3. Describe the Three Ways Evaporators Are Made

Activities:

- a. Read pages 89 to 91 in Environment Control.
- b. Watch a demonstration on the three types of evaporator construction.
- c. On the worksheet, name the three ways evaporators are made.

Materials:

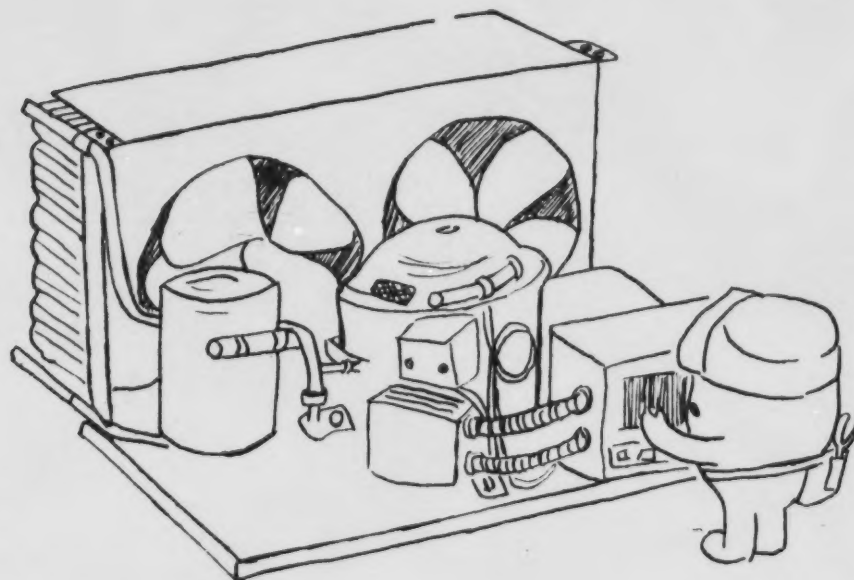
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

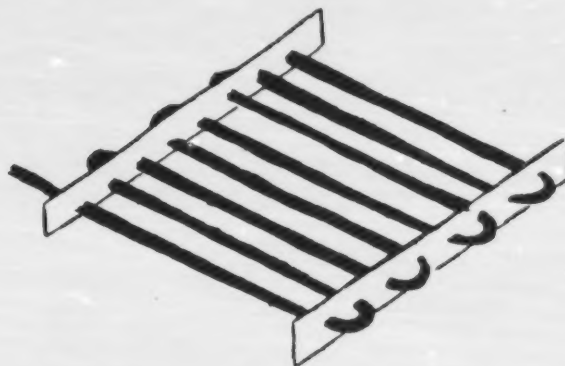
RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.



WORKSHEET

1. What type of evaporator construction is shown in the following sketch?



2. Describe the role of the evaporator in the refrigeration system.
3. Name the two types of evaporators used in the refrigeration system.
4. Name the three ways evaporators are made.

STUDENT ATTITUDE SHEET

for

CLUSTER

MANUFACTURING

UNIT

AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What An Evaporator Does In the Refrigeration System					
Knowing About Two Types of Evaporators					
Seeing How Evaporators Are Made					
QUESTIONS	YES.	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Describe Condensers and Receivers

LEARNING OBJECTIVES:

1. Describe the Function of a Condenser in the Refrigeration System

Activities:

- a. Read pages 95 to 96 in Environment Control.
- b. Watch a demonstration on the role of a condenser in a refrigeration system.
- c. On the worksheet, outline the role of a condenser in a refrigeration system.
- d. Watch the movie: Refrigeration - Condenser Controls.

Materials:

None

2. Describe the Function of a Receiver in the Refrigeration System

Activities:

- a. Read page 96 in Environment Control.
- b. Watch a demonstration on the role of a receiver in the refrigeration system.
- c. On the worksheet, outline the role of a receiver in the refrigeration system.

Materials:

None

3. Describe Three Ways of Cooling Condensers.

Activities:

- a. Read pages 96 to 100 in Environment Control.

- b. Watch a demonstration on the three ways to cool condensers.
- c. On the worksheet, describe the three ways to cool condensers.
- d. Name two basic construction forms of a water cooled condenser.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.

WORKSHEET

1. Outline the role of a condenser in the refrigeration system.
2. Outline the role of a receiver in the refrigeration system.
3. Describe three ways to cool a condenser.
4. TRUE or FALSE. A condenser takes cold vaporized refrigerant in and expels hot liquid refrigerant out.

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning What a Condenser Does In a Refrigeration System					
Seeing What a Receiver Does					
Knowing Three Ways to Cool a Condenser					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Air Conditioner Mechanic

OCCUPATIONAL COMPETENCY: Discuss the Residential Air Conditioner

LEARNING OBJECTIVES:

1. List the Major Parts of the Residential Air Conditioner System (Central Air)

Activities:

- a. Read pages 254 to 255 in Environment Control.
- b. Watch a demonstration showing the major parts of the residential air conditioner system.
- c. Look at a residential air conditioner system and identify the major parts.
- d. On the worksheet, draw a picture of a central air conditioner system and name the parts.

Materials:

None

2. Describe the Mechanical Components of the Common Cooling System

Activities:

- a. Read pages 257 to 259 in Environment Control.
- b. Watch a demonstration on the mechanical components of the common cooling system.
- c. Look at an air conditioner and discuss its cooling components.
- d. Describe the components of the air conditioner on the worksheet.

Materials:

Air conditioner

3. Discuss Refrigerants

Activities:

- a. Read page 259 in Environment Control.
- b. Watch a demonstration on refrigerants and their properties.
- c. On the worksheet, name three common refrigerants and their properties.

Materials:

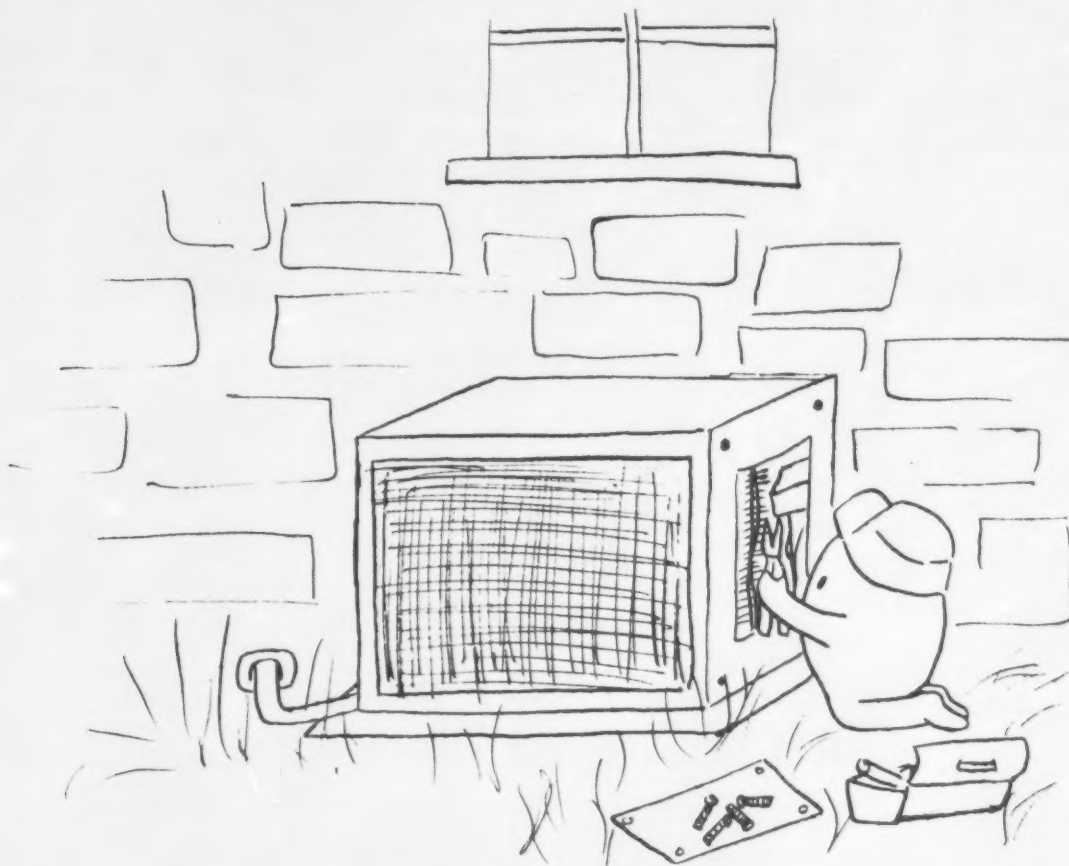
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Weaver, Michael K. and Kirkpatrick, James M. Environment Control.
New York, Harper and Row, Publishers, 1974.



WORKSHEET

1. In the space provided, draw a picture of a central air conditioner system and name the parts.
2. Tell where each of the mechanical components in a cooling system are located and explain how they operate.
3. Name three common refrigerants and discuss their properties.
4. TRUE or FALSE. Since leaks do occur in air conditioning systems, all refrigerants should be non-toxic and non-flammable.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT AIR CONDITIONER MECHANIC

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Parts of a Central Air Conditioning System					
Seeing What the Components Are in the Cooling System of an Air Conditioner					
Knowing About Refrigerants Used in Air Conditioning					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

UNIT OF STUDY: Custodian

DOT OCCUPATIONAL CATEGORY: Service

DOT OCCUPATIONAL DIVISION: Building and Related Service Occupations

DOT OCCUPATIONAL GROUP: Janitors

OCCUPATIONAL OVERVIEW: The custodian keeps hotels, office buildings, apartment houses and similar buildings in a clean and orderly condition. Tends furnaces, air conditioners and boilers to provide heat, cool air and hot water for tenants. Makes minor repairs to building, plumbing, electrical service and ventilation system. Cleans snow and debris from sidewalks, cuts grass, trains shrubs and paints walls.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

381.137-010	Supervisor, Janitorial Services
381.687-014	Cleaner, Commercial or Institutional
381.687-018	Cleaner, Industrial
381.687-034	Waxer, Floor
382.664-010	Janitor

LESSON 1

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Mop and Clean a Floor

LEARNING OBJECTIVES:

1. Name the Different Types of Floors

Activities:

- a. Read pages 1 to 9 in Its More Than Just A Floor.
- b. Watch a demonstration identifying floor types.
- c. Walk around your building and list the different floor types found.
- d. From an assortment of samples of flooring, identify each type of floor.
- e. Watch the movie: All About Floors.

Materials:

Assortment of floor samples

2. Tell How to Care for a Vinyl Tile Floor

Activities:

- a. Read pages 6 to 7 in More on Floors.
- b. Watch a demonstration on how to care for a vinyl floor.
- c. Tell where vinyl flooring can be used.

Materials:

None

3. Name the Two Types of Mopping

Activities:

- a. Read pages 1 to 10 in Mopping Floors.

- b. Watch a demonstration showing the two types of mopping.
- c. List the equipment used for each type of mopping.

Materials:

Paper, pencil

4. Outline How to Dust Mop a Floor

Activities:

- a. Read pages 2 to 5 in Mopping Floors.
- b. Watch a demonstration on how to dust mop a floor.
- c. Identify the four methods of dust mopping.
- d. Practice dust mopping in a room or hall which has been approved by your instructor.
- e. Watch the movie: Dust Mopping.

Materials:

Dust mop, dust mop treatment solution, dust pan and brush

5. Outline How to Wet Mop a Floor

Activities:

- a. Read pages 7 to 14 in Mopping Floors.
- b. Watch a demonstration on how to wet mop a floor.
- c. Practice wet mopping in a room or hall which has been approved by your instructor.
- d. Watch the movie: Damp Mopping.

Materials:

Wet mop, cleaning solution, wringer buckets

EVALUATION:

- 1. Identify a room or hall with a vinyl tile floor. Clean and wet mop the floor. Have your instructor check your work.

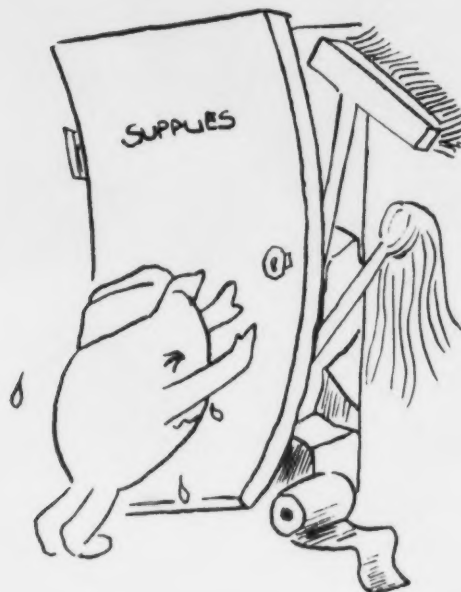
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Its More Than Just A Floor. Custodial Services Series, Packet Three. University of Maryland, 1978.

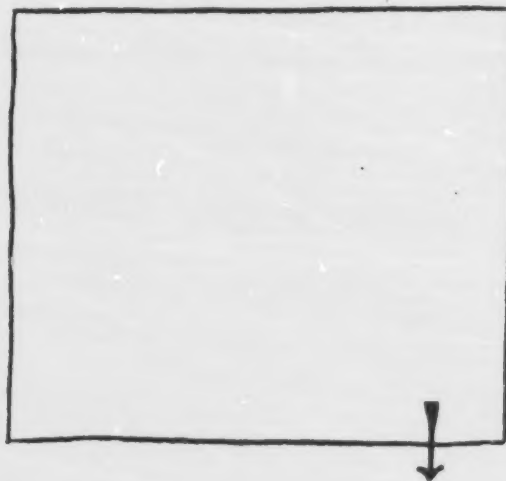
Mopping Floors. Custodial Services Series, Packet Five. University of Maryland, 1978.

More on Floors. Custodial Services Series, Packet Four, University of Maryland, 1978.



WORKSHEET

1. Define Resilient Flooring.
2. Of all soft flooring, which is used most often in new buildings?
3. List three different woods used in wood floors.
4. On which floors would you not use turpentine as a cleaner?
5. List three types of equipment used in wet mopping.
6. Pretend this square is a room. Show with your pencil the path you would take to wet mop the floor.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Knowing the Different Types of Floors					
Cleaning a Vinyl Floor					
Seeing How to Dust Mop a Floor					
Wet Mopping a Vinyl Floor					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Wax a Floor

LEARNING OBJECTIVES:

1. Tell How to Strip a Vinyl Tile Floor

Activities:

- a. Read pages 3 to 5 in Buffing, Stripping, and Waxing Floors.
- b. Watch a demonstration on how to strip a vinyl tile floor.
- c. Draw a diagram showing the best pattern to follow when stripping a floor.
- d. Practice stripping the floor of a room or hall which has been approved by the instructor.

Materials:

Paper, pencil, scrubbing machine, scrubbing machine brushes

2. Tell How to Wax a Vinyl Tile Floor

Activities:

- a. Read pages 8 to 11 in Buffing, Stripping, and Waxing Floors.
- b. Watch a demonstration on how to wax a vinyl tile floor.
- c. List the materials needed to wax a vinyl tile floor.
- d. Tell some things to consider when waxing a floor.
- e. Practice waxing the floor of a room or hall which has been approved by the instructor.

Materials:

Pencil, paper, liquid wax, wringer bucket, clean mop

3. Explain How to Buff a Waxed Floor

Activities:

- a. Read pages 11 to 12 in Buffing, Stripping, and Waxing Floors.
- b. Watch a demonstration on how to buff a waxed vinyl tile floor.
- c. Practice buffing a waxed vinyl tile floor in a room or hall which has been approved by the instructor.

Materials:

Scrubbing machine, scrubbing machine brushes

EVALUATION:

1. Using the floor identified in Lesson 1, strip the old wax and apply a new layer of wax. Buff the newly waxed floor. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Buffing, Stripping, and Waxing Floors. Custodial Services Series, Packet Six. University of Maryland, 1978.



WORKSHEET

1. Explain the following terms:

- a. Buffing
- b. Waxing
- c. Liquid Wax

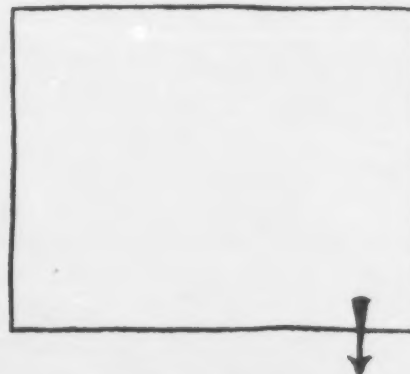
2. List the equipment needed for waxing a floor.

3. Identify this machine:



4. What is the difference between buffing a floor and scrubbing a floor?

5. Pretend this square is a room. Show with your pencil the method and path you would employ to buff the floor.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Stripping a Vinyl Tile Floor					
Waxing a Floor					
Buffing a Waxed Floor					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Clean Windows

LEARNING OBJECTIVES:

1. Identify the Tools for Window Cleaning

Activities:

- a. Read page 59 in Custodial Trainer's Manual.
- b. Watch a demonstration identifying the tools for window cleaning.
- c. From an assortment of cleaning equipment, identify each tool used in window cleaning.

Materials:

An assortment of cleaning equipment

2. Name the Two Methods for Cleaning Windows

Activities:

- a. Read page 59 in Custodial Trainer's Manual.
- b. Watch a demonstration explaining the different methods for cleaning windows.
- c. Name the tools and procedures unique to each method of window cleaning.

Materials:

None

3. Outline How to Clean Windows, with a Sponge and Squeegee

Activities:

- a. Read page 60 in Custodial Trainer's Manual.
- b. Watch a demonstration on how to clean windows with a sponge and squeegee.
- c. Practice cleaning the windows of the shop with the sponge and squeegee method.

Materials:

Sponge and squeegee, buckets, ladder, window cleaner

EVALUATION:

1. Identify some windows which need to be cleaned. Clean these windows with a sponge and squeegee method. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

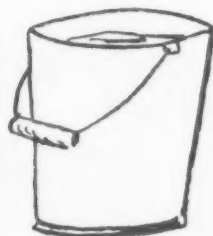
Custodial Trainer's Manual. Maintenance and Custodial Services Project, Curriculum Guide. West Virginia Department of Education, Charleston, W.V., 1974.



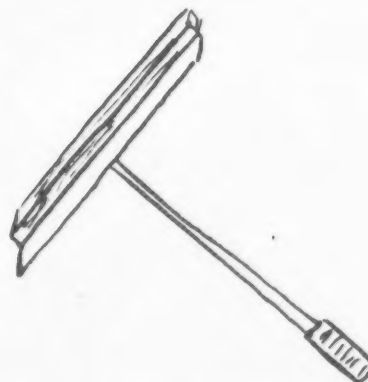
WORKSHEET

1. Name the two methods for cleaning windows.

2. Identify the following:



a. _____



b. _____

3. What three things commonly cause streaking on windows?

4. How do you wash heavy dirt from windows.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Methods for Cleaning Windows					
Knowing the Equipment for Cleaning Windows					
Cleaning Windows					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Finish a Wooden Table

LEARNING OBJECTIVES:

1. Tell How Abrasive Paper Is Made

Activities:

- a. Read pages 65 to 66 in Woodworking.
- b. Watch a demonstration on abrasive paper.
- c. From an assortment of abrasive paper, identify each by grit size and type.

Materials:

Assortment of abrasive paper

2. Discuss How Wood Is Sanded

Activities:

- a. Read pages 67 to 71 in Woodworking.
- b. Watch a demonstration on how to hand sand wood.
- c. Watch a demonstration on how to machine sand wood.
- d. Explain why you must always sand with the grain of the wood.
- e. Practice hand and machine sanding on scrap wood.

Materials:

Scrap wood, abrasive paper, electric power sander

3. Outline the Steps in Finishing a Wooden Table

Activities:

- a. Read pages 89 to 92 in Woodworking.
- b. Watch a demonstration on applying a finish to a wooden table.

- c. Tell what to consider when choosing a finish.
- d. Practice applying a finish to a piece of scrap wood.
- e. Watch the movie: Wood Finishing.

Materials:

Finish, brush, rag, solvent, scrap wood, absorbent paper

EVALUATION:

1. Get a small board from your instructor. Properly sand it smooth and apply a finish. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Spielman, Patrick E. Woodworking. Chicago, Illinois, American Technical Society, 1979.



WORKSHEET

1. What are the two kinds of abrasive material used in sandpaper?
2. Which sandpaper is coarser: 150 Grit or 60 grit?
3. Why should sanding be done with the grain?
4. Name the two most common types of electric sanders.
5. What considerations must be made for finishing wood surfaces that come in contact with food.
6. Outline how to apply a danish oil finish.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Abrasive Paper					
Sanding Down a Wooden Table					
Applying a Finish to a Wooden Table					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Clean a Lavatory

LEARNING OBJECTIVES:

1. Identify the Tools and Materials Needed to Clean a Lavatory

Activities:

- a. Read page 2 in Dear John.
- b. Watch a demonstration identifying the tools and equipment for cleaning lavatories.
- c. From an assortment of cleaning equipment, identify those tools and equipment needed for cleaning lavatories.

Materials:

Assortment of cleaning equipment

2. Outline the Twelve Steps to be Taken in Cleaning the Lavatory

Activities:

- a. Read pages 4 to 7 in Dear John.
- b. Watch a demonstration on cleaning a lavatory.
- c. List the twelve steps in cleaning a lavatory.
- d. Practice cleaning a lavatory while observing the twelve correct steps.
- e. Watch the movie: Restroom Cleaning Procedures.

Materials:

Trash bag, dust cloth, damp wiping cloth, sponges, chamois, bucket, broom, mop, toilet brush, gloves, putty knife, dust pan and broom

EVALUATION:

1. Clean a lavatory. Complete all twelve steps. Have the instructor check your work.

2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Dear John: The Art of Lavatory Cleaning. Custodial Services Series,
Packet Seven. University of Maryland, 1978.



WORKSHEET

1. Explain the best routine for cleaning the lavatory.

2. How do you clean a urinal?

3. What is the best procedure for cleaning wash basins?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Equipment to Clean a Lavatory					
Knowing the Procedure to Clean a Lavatory					
Cleaning a Lavatory					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Complete Minor Plumbing Repair

LEARNING OBJECTIVES:

1. Discuss the Basic Tools Used by the Plumber

Activities:

- a. Read pages 10 to 11 in Plumbing.
- b. Watch a demonstration identifying the basic tools of the plumber.
- c. From an assortment of tools, identify those tools used by the plumber.

Materials:

Assortment of tools

2. Outline How to Change a Trap on a Wash Basin

Activities:

- a. Read pages 50 to 51 in Plumbing.
- b. Watch a demonstration on how to change a trap on a sink.
- c. Look at a wash basin trap and see how it comes apart.
- d. Watch the movie: Plumbing - Joints.

Materials:

None

3. Outline How Plastic Pipe is Assembled

Activities:

- a. Read pages 76 to 77 in Plumbing.

- b. Watch a demonstration on working with plastic pipe.
- c. Get a scrap piece of plastic pipe from your instructor and cut it in half.

Materials:

Hacksaw, steel rule, vise, scrap plastic pipe

EVALUATION:

1. If your shop has a wash basin, remove the trap and clean out all blockages. Replace the trap and check for leaks. Have your instructor check your work.
2. Get two short pieces of plastic pipe and a coupler from your instructor. Prime, glue and assemble the pieces. Have your instructor check your work.
3. Complete the worksheet and submit it to your instructor for evaluation.
4. Complete the attitude sheet.

RESOURCES:

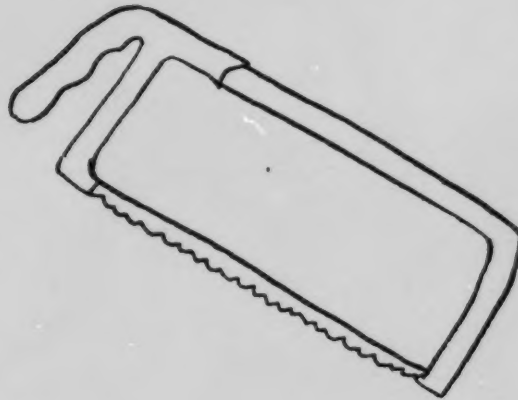
Plumbing. Time-Life Books, New York, 1976.

WORKSHEET

1. Identify the following tools.

a. _____

b. _____



2. When replacing a trap on a sink, what would happen if the threads were crossed and stripped?

3. Give a major advantage of plastic pipe over metal pipe.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Equipment Used By a Plumber					
Changing a Trap on a Wash Basin					
Working With Plastic Pipe					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Perform Minor Electrical Repairs

LEARNING OBJECTIVES:

1. Tell How to Wire a Single Pole Switch

Activities:

- a. Read pages 220 to 221 in Electrical Wiring.
- b. Read pages 43 to 44 in Basic Wiring.
- c. Watch a demonstration on wiring a single pole switch.
- d. Practice attaching wire to a single pole switch so that the joint is neat.

Materials:

Switch, wire, screw driver, insulation stripper

2. Tell How to Wire a Receptacle

Activities:

- a. Read pages 54 to 55 in Basic Wiring.
- b. Watch a demonstration on wiring a receptacle.
- c. Tell how to ground a receptacle.

Materials:

None

3. Tell How to Change Incandescent and Fluorescent Bulbs

Activities:

- a. Watch a demonstration on how to change an incandescent bulb.
- b. Watch a demonstration on how to change a fluorescent bulb.
- c. Practice removing and replacing bulbs while observing safety rules.

Materials:

Ladder, spare bulbs

EVALUATION:

1. At the work bench, wire a light bulb to a single-pole switch. Turn on the switch and see if the bulb lights. Have the instructor check your work.
2. Remove a fluorescent bulb from a fixture in your room. Replace it.
3. Complete the attitude sheet.

RESOURCES:

Basic Wiring. Time-Life Books, New York, 1976.

Herrick, Clyde N. Electrical Wiring Principles and Practices.
Englewood Cliffs, N.J., Prentice-Hall, Inc., 1975.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Wiring a Single Pole Switch					
Learning How to Wire a Receptacle					
Replacing a Fluorescent Bulb					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Maintain the Outside of the Building

LEARNING OBJECTIVES:

1. Tell How the Outside of the Building can be Cleaned

Activities:

- a. Read pages 1 to 9 in Outside Appearances.
- b. Watch a demonstration on cleaning the outside of the building.
- c. Identify tools and equipment useful for cleaning the outside of the building.
- d. Practice cleaning the outside of the building.

Materials:

Hose, litterstick

2. Identify Grasses Best Suited for your Area

Activities:

- a. Read pages 2 to 3 in The Grass Is Always Greener.
- b. Watch a demonstration identifying grasses best suited for a certain area.
- c. Name the different types of grasses.

Materials:

None

3. Tell How to Keep the Lawn Looking Neat

Activities:

- a. Read pages 3 to 15 in The Grass Is Always Greener.
- b. Watch a demonstration on how to keep the lawn looking neat.

Materials:

Lawnmower, fertilizer, fertilizer spreader, hose, trimmer

EVALUATION:

1. Clean the outside of your building. Have your instructor check your work.
2. Select, fertilize, plant and water grass seed which is best suited for your area. Have your instructor check your work.
3. Complete the worksheet and submit it to your instructor for evaluation.
4. Complete the attitude sheet.

RESOURCES:

Outside Appearances. Custodial Services Series, Packet Thirteen.
University of Maryland, 1978.

The Grass Is Always Greener: Lawn Care. Custodial Services Series,
Packet Fifteen. University of Maryland, 1978.



WORKSHEET

1. Why should entranceways to buildings get special cleaning attention?
2. How often does the exterior of the building need cleaning?
3. What are four things you must do before mowing the grass?
4. List five safety procedures you should follow when mowing grass.
5. If the grass at your building is very weak and full of weeds, what should you do?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Clean the Outside of the Building					
Identifying Lawn Grasses					
Working on the Grass Around the Building					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Control Insects and Rodents

LEARNING OBJECTIVES:

1. Tell How to Detect the Presence of Rodents

Activities:

- a. Read pages 5 to 6 in Aw Rats!
- b. Watch a demonstration on how to detect the presence of rodents.
- c. Look around the shop for signs of rodents.

Materials:

None

2. Outline Measures to Control Rats and Mice

Activities:

- a. Read pages 6 to 12 in Aw Rats!
- b. Watch a demonstration on how to control rats and mice.
- c. Tell the precautions of use rat poison to control rodents.
- d. Practice setting a mouse trap.
- e. Watch the movie: Ratproofing (2nd ed.).

Materials:

Mouse trap

3. Tell How to Control Selected Insects

Activities:

- a. Read pages 2 to 20 in How to Control Insect Pests.
- b. Watch a demonstration on controlling insects.

- c. List the common insect pests found around a building.
- d. Tell how to control selected insects.
- e. Watch the movie: DDT in the Control of Household Insects.

Materials:

Pencil, paper

EVALUATION:

1. Make an inspection of your building and determine what, if any, rodents and insects are present. Suggest ways of controlling these pests. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Aw Rats! Proper Rodent Control. Custodial Services Series, Packet Nine. University of Maryland, 1978.

How to Control Insect Pests. Custodial Services Series, Packet Ten. University of Maryland, 1978.

WORKSHEET

1. List five ways you can detect rodents in your building.

2. TRUE or FALSE. A mouse can squeeze through a hole as small as $\frac{1}{4}$ inch.

3. TRUE or FALSE. A rat will eat only food which people eat.

4. What are the most common multiple dose rat poisons?
How does this type poison kill?

5. Give three hints for the safe use of insecticides.

6. How should you dispose of insecticide containers?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Detect the Presence of Rodents					
Inspecting the Building for Insects and Rodents					
Knowing How to Control Pests					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Custodian

OCCUPATIONAL COMPETENCY: Describe Fire Prevention and Fire Fighting

LEARNING OBJECTIVES:

1. List Considerations for Fire Prevention

Activities:

- a. Read pages 2 to 4 in Hot Stuff.
- b. Watch a demonstration on how to prevent fires around the building.
- c. Inspect your shop and building for potential fire hazards.

Materials:

None

2. Name the Different Classes of Fire

Activities:

- a. Read pages 7 to 8 in Hot Stuff.
- b. Watch a demonstration on the different classes of fire.
- c. Describe the different classes of fire.
- d. Watch the movie: Extinguish That Fire.

Materials:

None

3. Tell How to Fight the Different Classes of Fire

Activities:

- a. Read pages 8 to 14 in Hot Stuff.
- b. Watch a demonstration on how to fight the different classes of fire.
- c. Name some common fire fighting devices and tell the class of fire they are used with.

Materials:

None

EVALUATION:

1. Locate the fire alarms in your building and see how to operate them. Locate all fire extinguishers and check their type and operation. Have your instructor check your work.
2. Complete the worksheet and submit it to your instructor for evaluation.
3. Complete the attitude sheet.

RESOURCES:

Hot Stuff: Fire Prevention and Fire Fighting. Custodial Services Series, Packet Eleven. University of Maryland, 1978.



WORKSHEET

1. For each example, tell which class of fire has started:

- _____ a. An electric toaster fire
- _____ b. A can of solvent catches fire
- _____ c. A bundle of newspapers catches fire
- _____ d. Smoke and flames erupt from a car engine

2. If you were the custodian in your building, what would you do if you discovered a major fire?

3. MATCHING. Match the type of fire extinguisher with the method for using them:

<u>Extinguishers</u>	<u>Method</u>
_____ Water type	1. Use a quick side to side motion
_____ Dry Chemical	2. Sweep slowly from side to side
_____ Carbon Dioxide	3. Direct the stream toward the floor in front of the fire
_____ Foam	4. Direct at the base of the fire
_____ Dry Powder	5. Shovel on

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT CUSTODIAN

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Prevent Building Fires					
Knowing the Classes of Fire and How to Fight Them					
Checking Fire Extinguishers for Type and Use					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

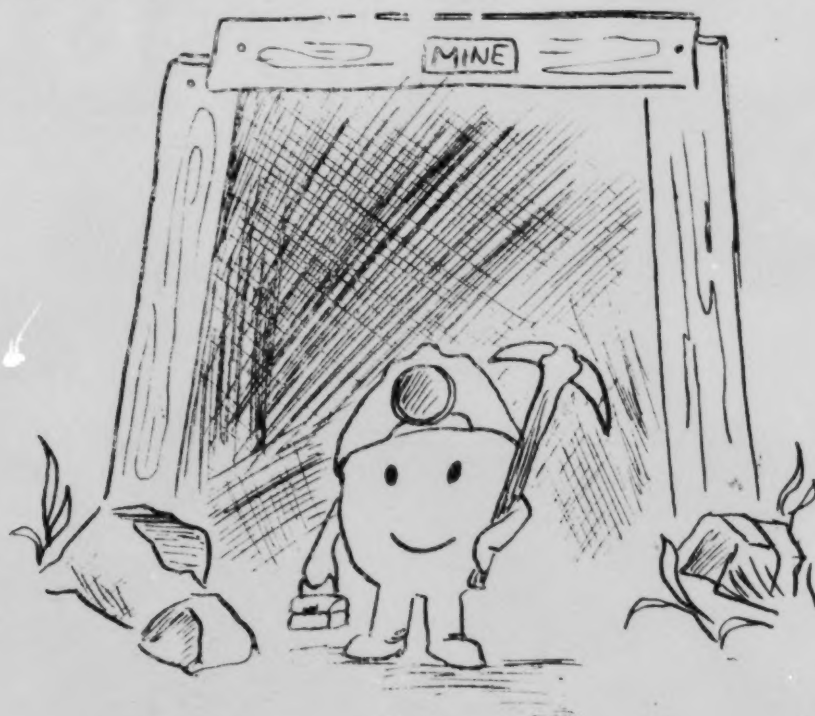
UNIT OF STUDY: Coal Miner

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Extraction of Minerals

DOT OCCUPATIONAL GROUP: Extraction of Minerals

OCCUPATIONAL OVERVIEW: The coal miner seeks and extracts coal in underground and surface mines while performing many tasks and operating many machines. Sets up and uses continuous mining machines, roof bolters, loading machines, conveyor belts and shuttle cars. Detonates explosives, shovels coal, installs timbering, lays track and surveys mine.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

939.281-010	Miner
930.665-010	Long Wall Mining Machine Tender
930.683-010	Continuous-Mining Machine Operator
930.683.026	Roof Bolter
931.261-010	Blaster
932.683-014	Loading-Machine Operator
939.585-010	Dust Sampler

792

LESSON 1

UNIT: Coal Miner

COMPETENCY STATEMENT: Describe Coal

LEARNING OBJECTIVES:

1. Describe the Four Kinds of Coal

Activities:

- a. Read page 2 in The Story of Coal.
- b. Watch a demonstration on how you can tell one kind of coal from another.
- c. Look at an assortment of coal and identify each kind.

Materials:

Assortment of coal

2. Tell How Coal Was Formed

Activities:

- a. Read pages 51 to 52 in Underground Mining.
- b. Watch a demonstration on how coal was formed.
- c. Draw a map showing the location of the various coal areas in the United States.

Materials:

Paper, pencil

3. Name Some Jobs Done in a Coal Mine

Activities:

- a. Watch the movie: Coal Miner - Today.
- b. Name five jobs done in an underground coal mine.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Martens, Charles D. Underground Mining. Joy Manufacturing Co., 1972.

The Story of Coal. Bethlehem Steel Corp., 1979.



WORKSHEET

1. Which is the hardest coal?
2. On the following map of the United States, draw where the four types of coal deposits are located.



3. Tell what the following people do in an underground mine:
 - a. miner operator
 - b. roof bolter
 - c. section boss
 - d. dispatcher

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out About the Different Kinds of Coal					
Learning How Coal Was Formed					
Learning About Jobs in a Coal Mine					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Three Types of Underground Mines

LEARNING OBJECTIVES:

1. Name the Three Types of Underground Mines

Activities:

- a. Read pages 7 to 8 in Introduction to Underground Coal Mining.
- b. Watch a demonstration identifying the three types of underground mines.
- c. Watch the movie: The Harvesting of Coal.

Materials:

None

2. Describe the Nature of Each Type of Underground Mine

Activities:

- a. Read pages 7 to 8 in Introduction to Underground Coal Mining.
- b. Watch a demonstration which describes the nature of each type of underground mine.
- c. Tell why the three types of underground mines are built the way they are.
- d. Draw a sketch of each type of underground mine.

Materials:

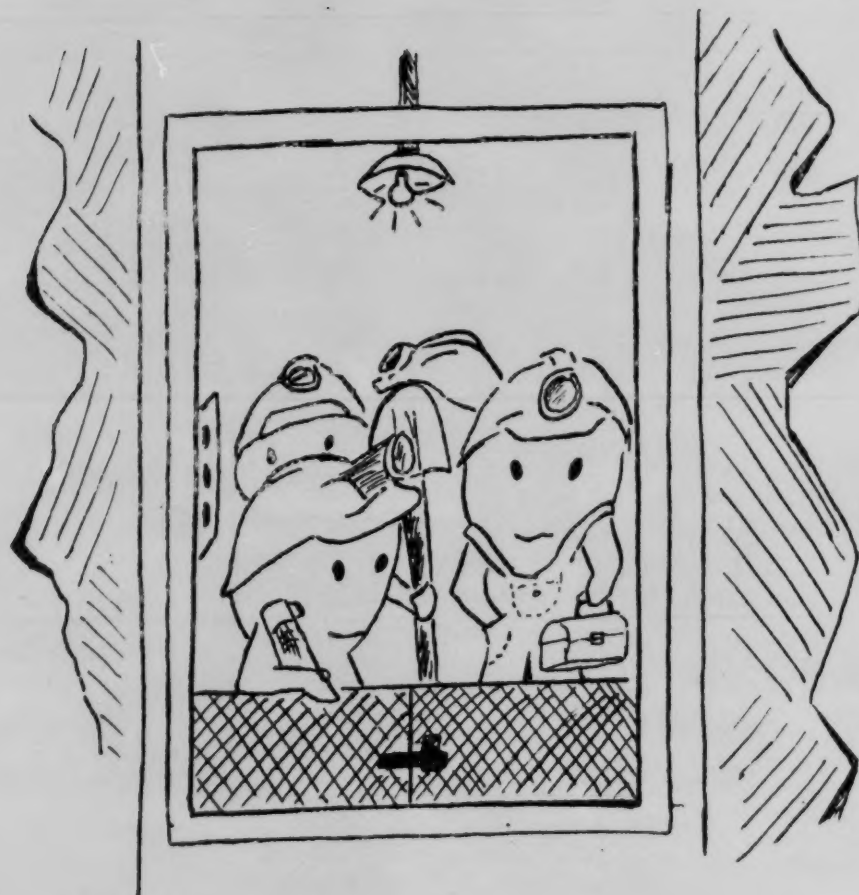
Pencil, paper

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

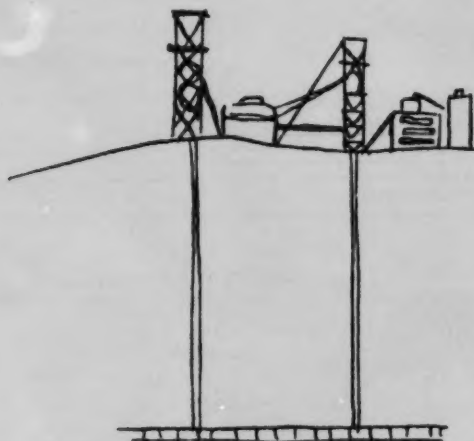
RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.

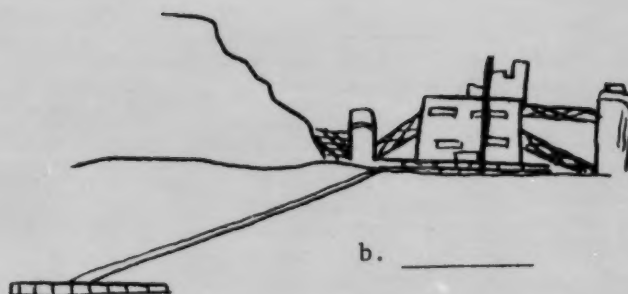


WORKSHEET

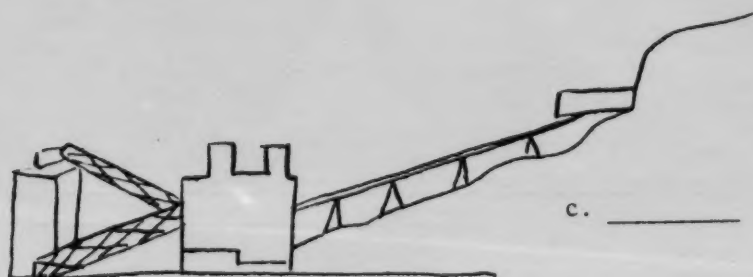
1. Identify the following mine types:



a. _____



b. _____



c. _____

2. Describe how a shaft mine operates.

3. How deep are shaft mines?

NAME _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Three Types of Underground Coal Mines					
Finding Out How Underground Mines Operate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Coal Miner

COMPETENCY STATEMENT: Describe Five Methods to Mine Coal in an Underground Mine

LEARNING OBJECTIVES:

1. Name the Five Methods of Mining Coal in an Underground Mine

Activities:

- a. Read pages 9 to 13 in Introduction to Underground Coal Mining.
- b. Watch a demonstration identifying the five methods of mining coal in an underground mine.
- c. Watch the slide/tape show: Introduction to Underground Coal Mining: One.

Materials:

None

2. Define Room and Pillar Mining

Activities:

- a. Read page 14 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on how a mine operates on a room and pillar basis.
- c. Draw a picture of what a room and pillar mine looks like.

Materials:

Pencil and paper

3. Define Retreat Mining

Activities:

- a. Read page 15 in Introduction to Underground Coal Mining.

- b. Watch a demonstration on how retreat mining occurs.
- c. Draw a picture of explaining the procedure of retreat mining.

Materials:

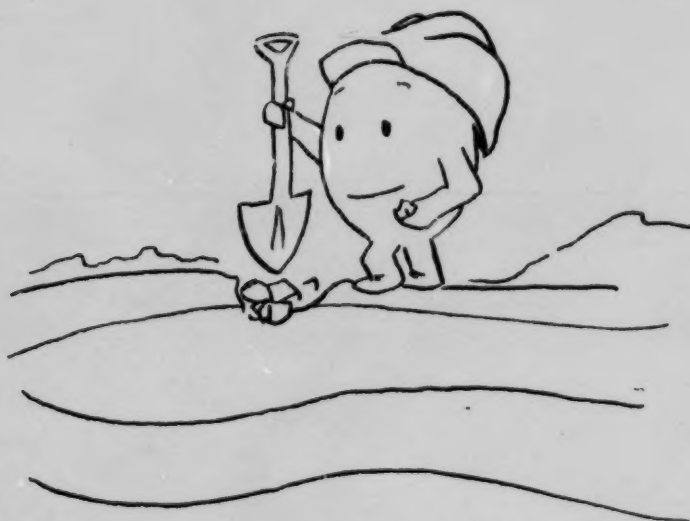
Pencil, paper

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

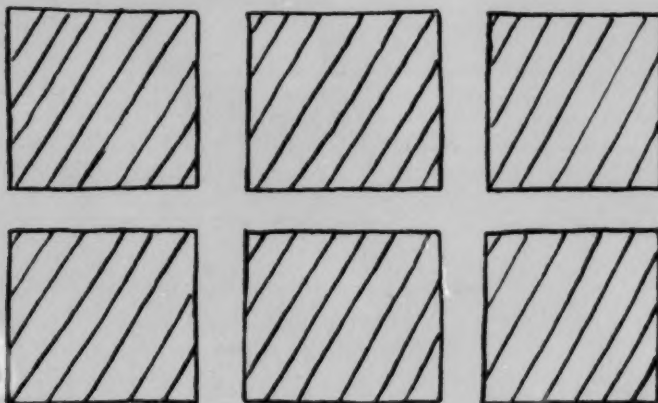
Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.



WORKSHEET

1. Name the five methods of mining coal in an underground mine.

2. What type of mining method is shown in the following:



3. What is the name of the method in which coal is removed from roof-supporting pillars until the roof caves in?

4. Which form of mining uses explosives?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Finding Out About the Five Methods of Mining Coal					
Seeing How Mines are Rooms and Pillars					
Knowing What Retreat Mining Is					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Conventional Mining and Equipment

LEARNING OBJECTIVES:

1. Name the Five Steps in the Conventional Mining of Coal

Activities:

- a. Read page 33 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on identifying the five steps in conventional coal mining.

Materials:

None

2. Identify the Equipment Used in the Conventional Mining of Coal

Activities:

- a. Read page 45 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on equipment used in conventional mining of coal.
- c. From an assortment of drawings and photographs, identify the equipment used in conventional coal mining.

Materials:

Assortment of drawings and photographs of mining equipment

3. Describe How Each Step of Conventional Mining Is Done

Activities:

- a. Read pages 46 to 54 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on how each step of conventional mining is done.

- c. Draw a picture of a room and pillar mine and explain how conventional mining is done.
- d. Watch the movie: Underground Coal Mine Blasting.

Materials:

Paper, pencil

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.



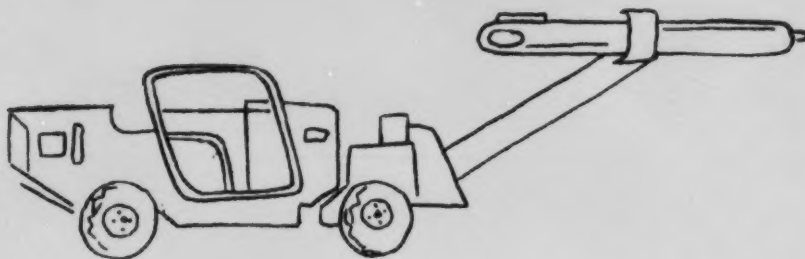
WORKSHEET

1. Name the five steps in the conventional mining of coal.

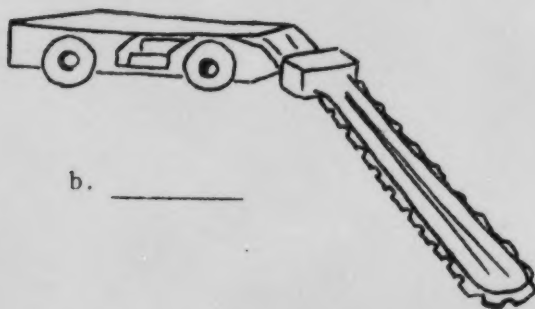
- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

2. TRUE or FALSE. The process of cutting into and along the wall of coal being mined to provide a places for coal to go when blasted is called shooting the face.

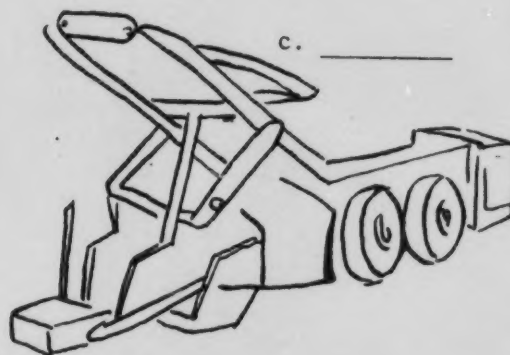
3. Identify the following conventional mining equipment.



a. _____



b. _____



c. _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Steps in the Conventional Mining of Coal					
Identifying Conventional Coal Mining Equipment					
Finding Out How Each Step of Conventional Mining Is Done					
QUESTIONS	YES .	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Continuous Mining and Equipment

LEARNING OBJECTIVES:

1. Name the Three Steps in the Continuous Mining of Coal

Activities:

- a. Read page 55 in Introduction to Underground Coal Mining.
- b. Watch a demonstration identifying the three steps in continuous coal mining.

Materials:

None

2. Identify the Equipment Used in the Continuous Mining of Coal

Activities:

- a. Read page 55 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on equipment used in continuous coal mining.
- c. From an assortment of drawings and photographs, identify the equipment used in the continuous mining of coal.

Materials:

Assortment of drawings and photographs of continuous coal mining equipment

3. Describe How Each Step in Continuous Mining Is Done

Activities:

- a. Read pages 55 to 56 in Introduction to Underground Coal Mining.
- b. Watch a demonstration showing how each step in continuous coal mining is done.

- c. Tell what each piece of equipment does in continuous coal mining.
- d. Draw a picture of a room and pillar mine and explain how continuous coal mining is done.

Materials:

Pencil, paper

4. Describe Continuous Auger Mining

Activities:

- a. Read pages 57 to 58 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on continuous auger mining.
- c. Name the equipment used in continuous auger mining.
- d. Draw a picture of a room and pillar mine and explain how continuous auger mining is done.

Materials:

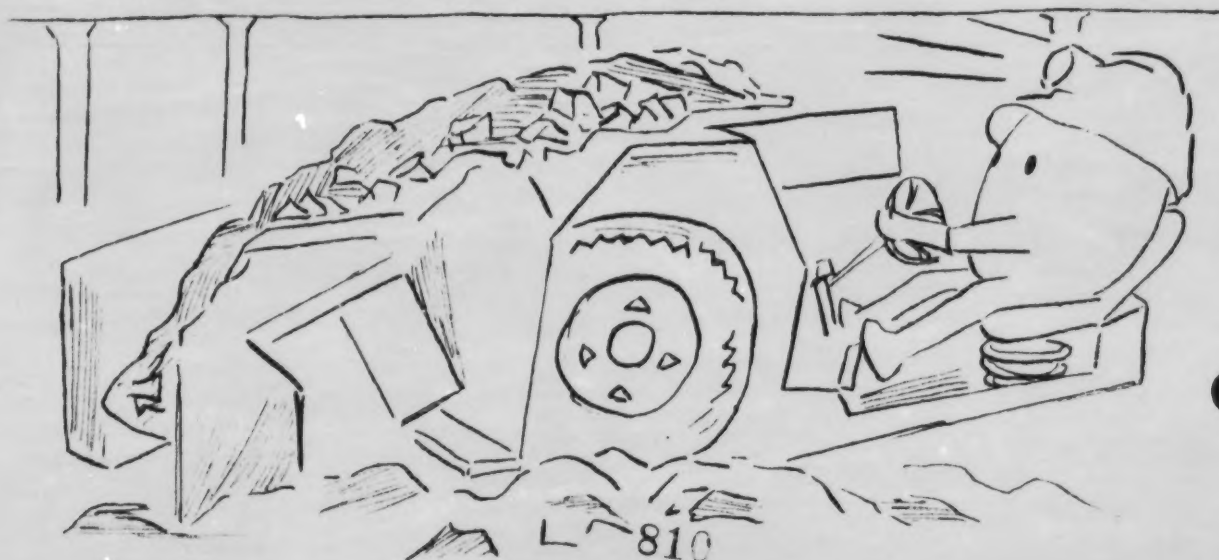
Pencil, paper

EVALUATION:

- 1. Complete the worksheet and submit it to your instructor for evaluation.
- 2. Complete the attitude sheet.

RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.



WORKSHEET

1. Name the three steps in the continuous mining of coal.

a. _____

b. _____

c. _____

2. TRUE or FALSE. With continuous mining, roof bolting is not necessary.

3. TRUE or FALSE. The continuous miner can mine into the face only as far as the operator is under supported roof.

4. Identify the following piece of equipment.

a. _____



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Steps in the Continuous Mining of Coal					
Identifying Continuous Coal Mining Equipment					
Finding Out How Each Step of Continuous Mining Is Done					
Learning About Auger Mining					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Longwall Mining and Equipment

LEARNING OBJECTIVES:

1. Identify the Equipment Used in the Longwall Mining of Coal

Activities:

- a. Read pages 59 to 60 in Introduction to Underground Coal Mining.
- b. Watch a demonstration identifying longwall coal mining equipment.
- c. From an assortment of drawings and photographs, identify the equipment used in the longwall mining of coal.

Materials:

Assortment of drawings and photographs of longwall mining equipment

2. Describe the Longwall Mining of Coal

Activities:

- a. Read pages 59 to 60 in Introduction to Underground Coal Mining.
- b. Watch a demonstration on how longwall coal mining is done.
- c. Draw a picture of a mine, explain the conditions for longwall coal mining and tell how it is done.
- d. Watch the movie: Safety in Longwall Mining.

Materials:

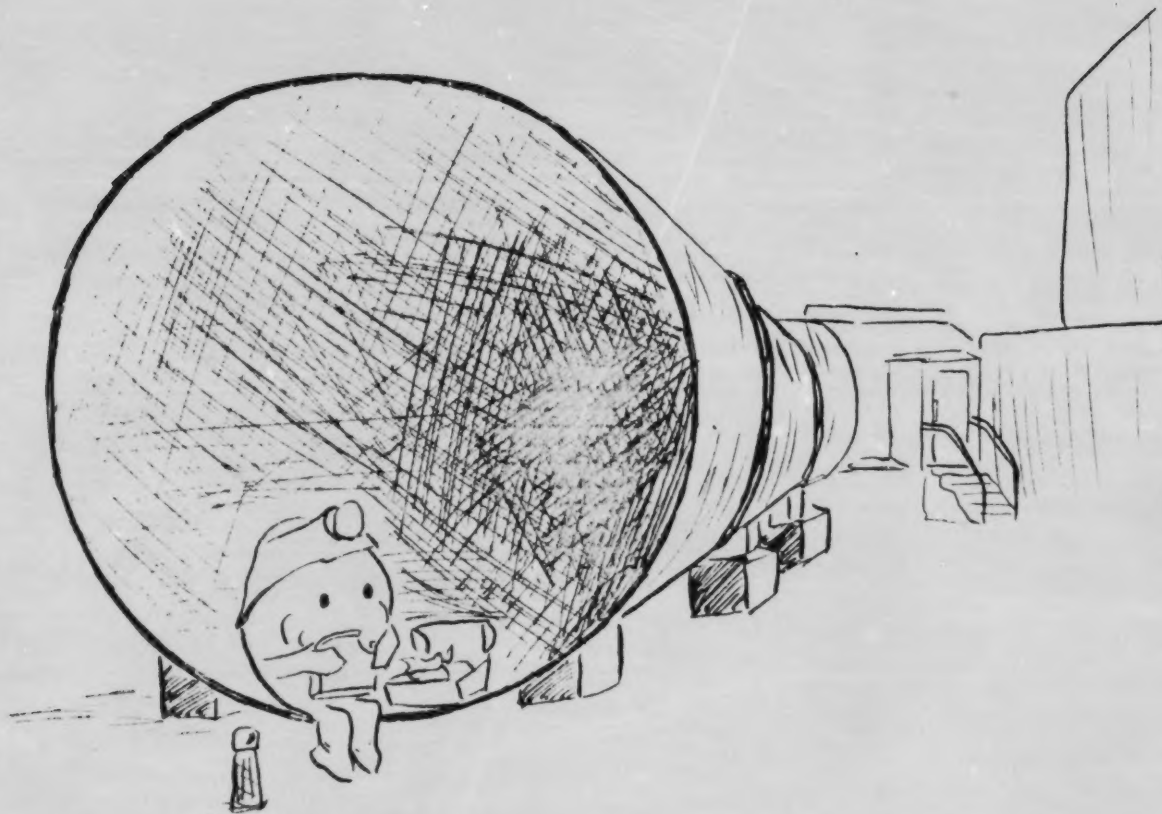
Pencil, paper

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining
Enforcement and Safety Administration, 1977.



WORKSHEET

1. Draw a picture of a longwall mine and write how it operates.

2. Identify the following piece of equipment.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Identifying the Equipment Used in the Longwall Mining of Coal					
Learning About the Longwall Mining of Coal					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Roof Control in an Underground Mine

LEARNING OBJECTIVES:

1. Tell the Reasons Why a Mine Roof Will Fall

Activities:

- a. Read pages 276 to 277 in Underground Mining.
- b. Watch a demonstration on why mine roofs fall.
- c. Give three conditions for a mine roof to fall.

Materials:

None

2. Explain How to Test a Roof for Safety

Activities:

- a. Read pages 277 to 278 in Underground Mining.
- b. Watch a demonstration on how to test a roof for safety.
- c. Define "kettle bottom".
- d. Tell why a crowbar is used in scaling and not a hammer.

Materials:

None

3. Name the Devices Used to Support a Roof

Activities:

- a. Read pages 278 to 287 in Underground Mining.
- b. Watch a demonstration showing the devices to support a roof.
- c. Draw a roof bolt.
- d. Explain how strong black locust would be as a support post in a mine.

Materials:

Pencil, paper

4. Explain How a Roof Is Bolted

Activities:

- a. Read pages 287 to 294 in Underground Mining.
- b. Read pages 115 to 121 in Introduction to Underground Coal Mining.
- c. Watch a demonstration on how a roof is bolted.
- d. Explain how a roof bolter works.
- e. Watch the movie: Roof Bolting in Coal Mines.

Materials:

None

5. Describe a Typical Roof Bolting Plan

Activities:

- a. Read page 295 in Underground Mining.
- b. Watch a demonstration on a typical roof bolting plan.
- c. Draw a picture of a roof bolting plan and tell how far away they are spaced.

Materials:

Pencil, paper

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.

Martens, Charles D. Underground Mining. Joy Manufacturing Co., 1972.

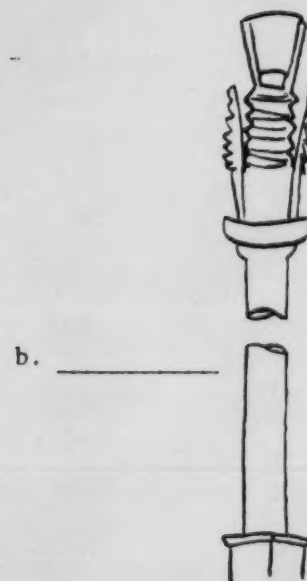
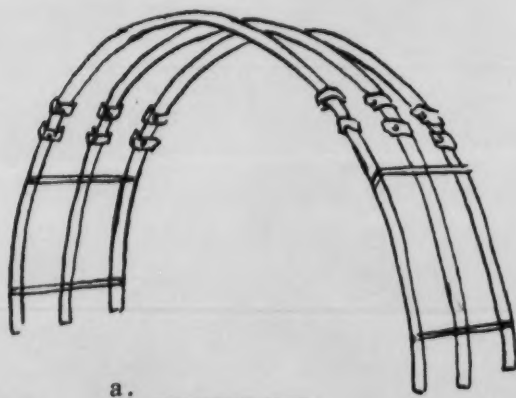
WORKSHEET

1. Draw a picture of a mine room and explain the nature of the force from the overburden.

2. Define scaling.

3. Draw a roof bolting plan.

4. Identify the following:



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning Why a Mine Roof Might Fall					
Seeing How to Test a Mine Roof For Safety					
Knowing the Devices to Support a Mine Roof					
Learning How a Roof is Bolted					
QUESTIONS	YES.	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Coal Miner

COMPETENCY STATEMENT: Describe Three Types of Surface Mines

LEARNING OBJECTIVES:

1. Name the Three Types of Surface Mines

Activities:

- a. Read pages 5 to 12 in Surface Mining.
- b. Watch a demonstration identifying the three types of surface mines.
- c. Watch the movie: Energy vs Ecology - The Great Debate.

Materials:

2. Describe Each of the Three Surface Mines

Activities:

- a. Read page 5 to 12 in Surface Mining.
- b. Watch a demonstration describing the three types of surface mines.
- c. Name the four kinds of contour stripping.
- d. Draw a series of pictures describing area stripping.

Materials:

Pencil, paper

EVALUATION:

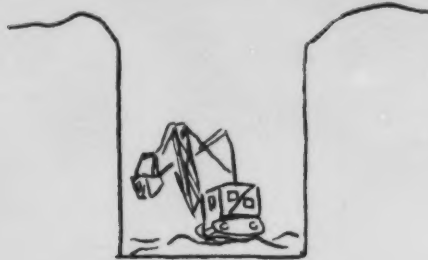
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

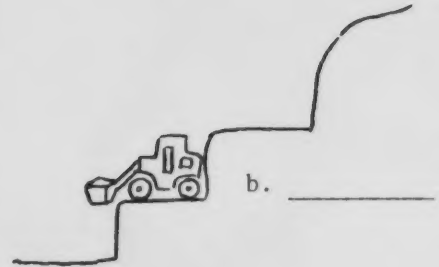
Surface Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1976.

WORKSHEET

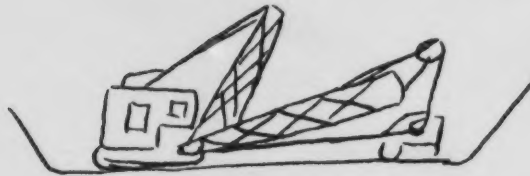
1. Identify the following surface mines:



a. _____



b. _____



c. _____

2. TRUE or FALSE. Contour mining is done in the flat mid-west states.

3. Define Fragmentation.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Types of Surface Mines					
Knowing How Surface Mines Operate					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Coal Miner

COMPETENCY STATEMENT: Discuss Surface Mining Equipment

LEARNING OBJECTIVES:

1. Tell What Determines the Type of Equipment to be Used in Surface Mining

Activities:

- a. Read page 14 in Surface Mining.
- b. Watch the movie: Safety in Strip Mining.

Materials:

None

2. Identify the Equipment Used for Surface Mining

Activities:

- a. Read pages 14 to 24 in Surface Mining.
- b. Watch a demonstration on identifying surface mining equipment.
- c. From an assortment of drawings and photographs, identify the equipment used in the surface mining of coal.

Materials:

None

3. Tell How Various Surface Mining Equipment Is Used

Activities:

- a. Read pages 15 to 24 in Surface Mining.
- b. Watch a demonstration on how surface mining equipment operates and is used.
- c. Watch the movie: New Concept in Mining.

Materials:

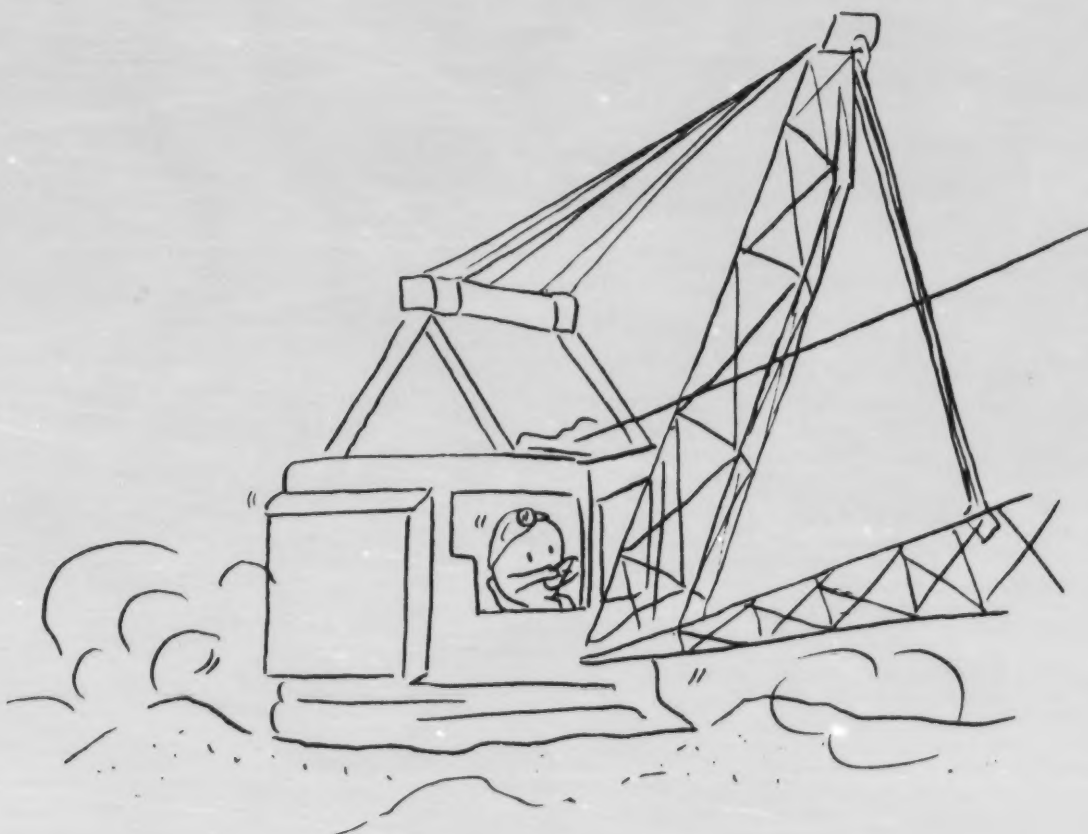
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

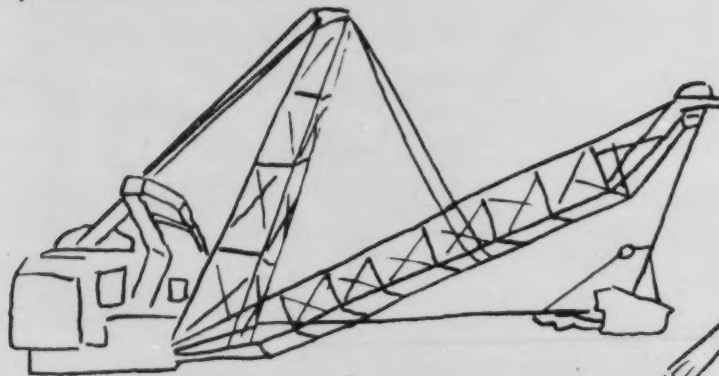
RESOURCES:

Surface Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1976.

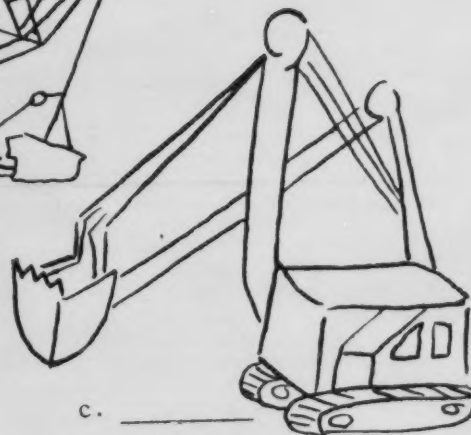


WORKSHEET

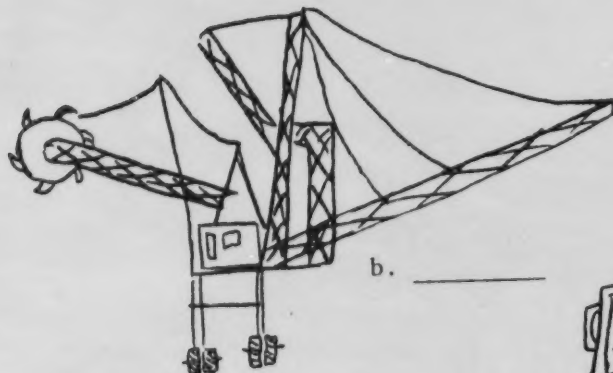
1. Identify the following equipment:



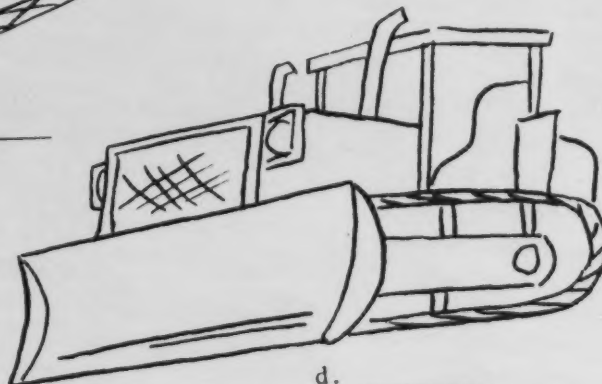
a. _____



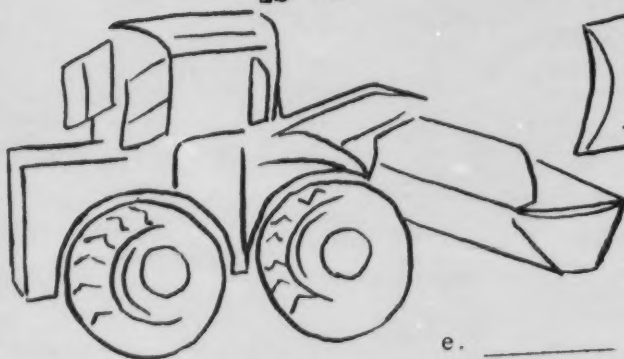
c. _____



b. _____



d. _____



e. _____

2. Name the equipment used to remove overburden in a surface mine which is loose and needs no blasting.

NAME _____ 817

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Surface Mining Equipment					
Identifying Surface Mining Equipment					
Knowing What Different Surface Mining Equipment Is Used For					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Coal Miner

COMPETENCY STATEMENT: Tell How Coal Is Cleaned and Processed

LEARNING OBJECTIVES:

1. Tell How Coal Is Sized

Activities:

- a. Read page 252 in Introduction to Underground Coal Mining.
- b. Read pages 20 to 22 in The Story of Coal.
- c. Watch a demonstration on how coal is sized.

Materials:

None

2. Explain How Coal Is Cleaned and Processed

Activities:

- a. Read page 252 in Introduction to Underground Coal Mining.
- b. Read pages 20 to 22 in The Story of Coal.
- c. Watch a demonstration on how coal is cleaned and processed.
- d. Draw a flow chart explaining how coal is cleaned and processed.

Materials:

Pencil, paper

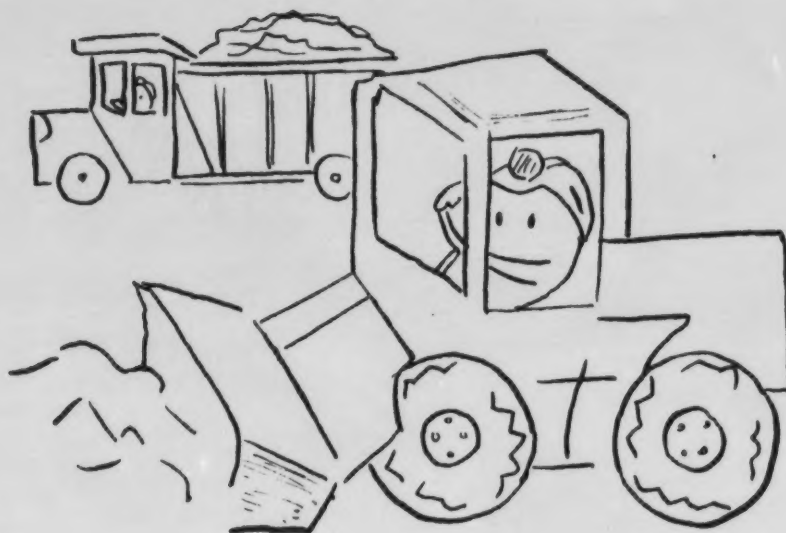
EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Introduction to Underground Coal Mining. Beckley, W.V., Mining Enforcement and Safety Administration, 1977.

The Story of Coal. Bethlehem Steel Corp., 1979.



WORKSHEET

1. Define Crusher
2. What does the raw coal screen do in the processing of coal.
3. Draw a diagram at a modern coal processing operation.

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT COAL MINER

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How Coal Is Sized					
Knowing How Coal Is Cleaned and Processed					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

CAREER INFORMATION SHEET

UNIT OF STUDY: Warehouse Operator

DOT OCCUPATIONAL CATEGORY: Miscellaneous

DOT OCCUPATIONAL DIVISION: Packaging and Materials Handling

DOT OCCUPATIONAL GROUP: Packaging and Materials Handling

OCCUPATIONAL OVERVIEW: The warehouse operator receives, transports, stacks, fills orders for, ships and maintains stock in a warehouse. May label, case or pack materials for storage or shipping. Operates conveyor belts, fork lifts, loaders and overhead cranes.



REPRESENTATIVE JOB TITLES WITH DOT CODES:

920.587-018	Packages, Hand
921.133-018	Material Handling Supervisor
921.662-018	Conveyor-System Dispatcher
929.137-022	Warehouse Supervisor
929.687-030	Material Handler

LESSON 1

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Identify Material Handling Equipment

LEARNING OBJECTIVES:

1. List the Principles of Materials Handling

Activities:

- a. Read pages 14 to 15 in Warehousing.
- b. Watch a demonstration on the identification of the basic principles of materials handling.
- c. List and discuss the principles of materials handling.

Materials:

Paper, pencil

2. Name the Types and Categories of Materials Handling Equipment

Activities:

- a. Read pages 15 to 16 in Warehousing.
- b. Watch a demonstration on how materials handling equipment is classified.
- c. Tell the classification of selected material handling equipment.

Materials:

None

3. Identify Materials Handling Equipment

Activities:

- a. Read pages 16 to 27 in Warehousing.
- b. Watch a demonstration on identifying materials handling equipment and their use.
- c. From an assortment of drawings, photographs, and items of equipment, identify equipment used in warehousing and tell how it is used.

- d. Watch the movie: Materials Handling in Receiving, Warehousing and Shipping.
- e. Watch the movie: Materials Handling in Transportation.

Materials:

Assortment of drawings, photographs and items of equipment

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

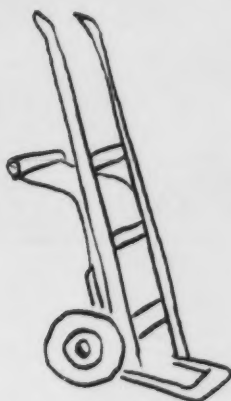
RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.

WORKSHEET

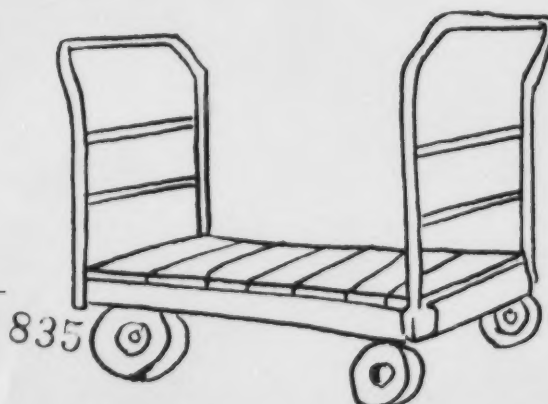
1. Define materials handling.
2. What is meant by "The least handling is the best handling?"
3. Why should equipment ratings never be exceeded?
4. How are major equipment items generally classified?
5. Name the four types of conveyors.
 - a. _____
 - b. _____
 - b. _____
 - d. _____
6. Identify the following equipment:

a. _____



b. _____

c. _____



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STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Handle Material					
Finding Out About Material Handling Equipment					
Learning What Some Equipment Is Used For					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 2

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Tell How to Operate a Forklift

LEARNING OBJECTIVES:

1. List the Proper Techniques for Forklift Operation

Activities:

- a. Read pages 35 to 36 in Warehousing.
- b. Watch a demonstration on the proper techniques for forklift operation.
- c. Watch a forklift in operation and list proper and improper techniques used by the driver.

Materials:

None

2. Give Some Suggestions for Operating a Forklift

Activities:

- a. Read page 37 in Warehousing.
- b. Watch a demonstration giving suggestions for operating a forklift.

Materials:

None

3. List the Safety Rules for Forklift Operation

Activities:

- a. Read pages 38 to 39 in Warehousing.
- b. Watch a demonstration listing the safety rules for forklift operation.
- c. Watch a forklift in operation and list any violations of the safety rules.

Materials:

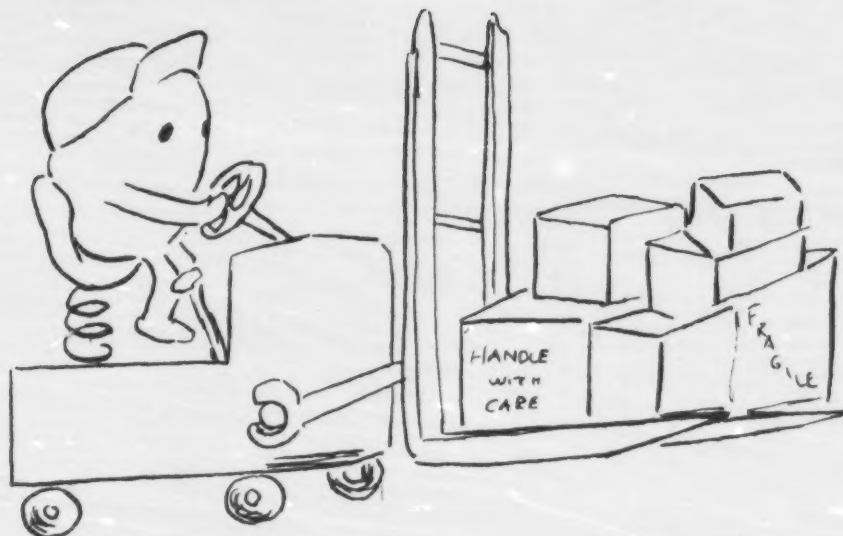
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.



WORKSHEET

1. What is a forklift designed to do?
2. Give three safety procedures to follow when operating a forklift.
 - a.
 - b.
 - c.
3. Explain how to pick up a pallet with a forklift.
4. Why should slow, easy starts and smooth stops be made with the forklift?
5. What is this forklift operator doing wrong?



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning the Proper Techniques For Using a Forklift					
Knowing How to Safely Use a Forklift					
Seeing What a Forklift Does					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 3

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Describe a Warehouse Receiving Operation

LEARNING OBJECTIVES:

1. Tell How to Accurately Check Received Merchandise

Activities:

- a. Read pages 43 to 47 in Warehousing.
- b. Watch a demonstration on accurately checking received merchandise.
- c. Identify the forms and tickets used in receiving goods.
- d. Tell what is included on an inbound shipment register.

Materials:

None

2. Describe How to Unload Received Merchandise

Activities:

- a. Read pages 48 to 53 in Warehousing.
- b. Watch a demonstration on how to unload received merchandise.
- c. Discuss the considerations for unloading railroad boxcars and motor trucks.
- d. Draw a picture showing how you would unload a boxcar of shop supplies which was delivered to the front door of the school.

Materials:

Pencil, paper

3. Discuss the Record System for Received Merchandise

Activities:

- a. Read pages 55 to 61 in Warehousing.

- b. Watch a demonstration showing the record system for received merchandise.
- c. Identify the forms used in recording received goods.

Materials:

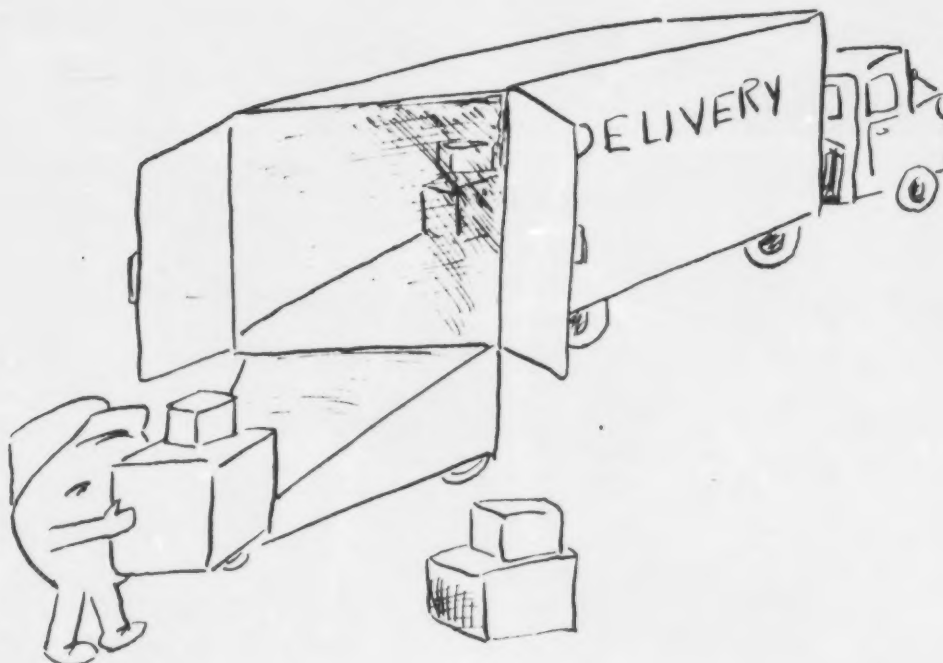
None

EVALUATION:

- 1. Complete the worksheet and submit it to your instructor for evaluation.
- 2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.



WORKSHEET

1. What is the basic requirement of effective warehousing?
2. Explain the procedure for unloading a boxcar when the goods will be stored close by.
3. Explain what a common carrier is.
4. From the following invoice, identify:
 - a. Who sent the goods _____
 - b. Who was the carrier? _____
 - c. How many motors were received? _____
 - d. What was backordered? _____

BILL'S RADIO HUT
 PHONE 782-9310 187 LAWNMAN AVE.
 ROADPORT, IND. 07281

SOLD TO _____ DATE 10-3-80
 ADDRESS _____ PHONE _____
 VIA MOTOR FREIGHT CHARGE NA WT. 2103 LBS.

QUANTITY	ITEM	PRICE	TOTALS
10	RADIOS	@ 5.00	\$ 50.00
2	MOTORS	10.00	20.00
1	BATTERY	1.95	BACKORDERED
3	CASSETTES	3.50	11.00
SUB TOTAL			82.95
TAX			2.00
TOTAL			\$ 84.95

FORM 809-2-37 RECEIVED BY 20 Am

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Seeing How to Check Received Merchandise					
Learning How to Unload Received Merchandise					
Knowing How to Set Up a Record System					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 4

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Discuss Warehouse Storage Procedures

LEARNING OBJECTIVES:

1. Identify Commodity and Capacity Factors in Storage Space Layout

Activities:

- a. Read pages 63 to 65 in Warehousing.
- b. Watch a demonstration identifying commodity and capacity factors in storage space layout.
- c. List commodity factors in space layout and tell why they are important.
- d. List capacity factors in space layout and tell why they are important.

Materials:

None

2. Discuss Other Factors in Storage Space Usage

Activities:

- a. Read pages 66 to 70 in Warehousing.
- b. Watch a demonstration on other factors in storage space usage.
- c. Explain what to consider in laying out an aisle.

Materials:

None

3. Outline Proper Storage Methods

Activities:

- a. Read pages 73 to 83 in Warehousing.

- b. Watch a demonstration on how to properly store merchandise.
- c. List factors in proper storage methods.
- d. Name some things around the shop which are stored in bins. On shelves. On the floor.

Materials:

None

4. Name the Various Storage Devices

Activities:

- a. Read pages 85 to 96 in Warehousing.
- b. Watch a demonstration on identifying the various storage devices.
- c. Name the different types of pallets and tell their use.

Materials:

None

5. Tell How to Store Hazardous and Perishable Merchandise

Activities:

- a. Read pages 99 to 113 in Warehousing.
- b. Watch a demonstration on how to store hazardous and perishable merchandise.
- c. Look around the shop for hazardous and perishable materials and see how they are stored.

Materials:

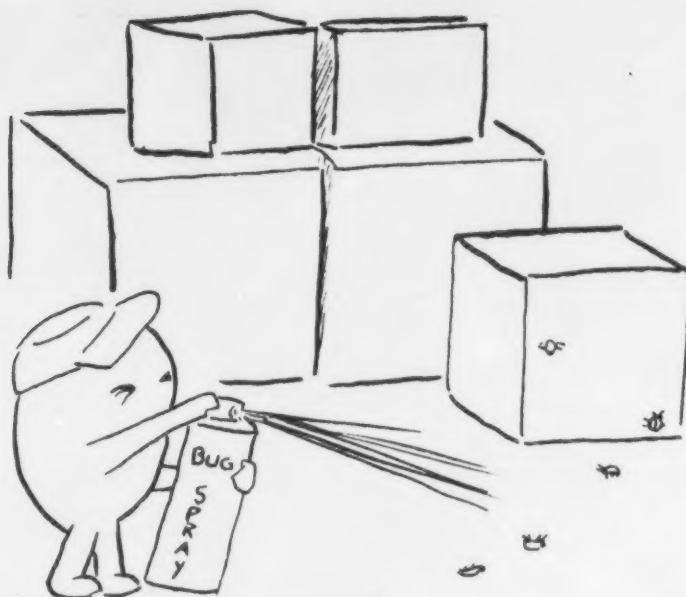
None

EVALUATION:

- 1. Complete the worksheet and submit it to your instructor for evaluation.
- 2. Complete the attitude sheet.

RESOURCES:

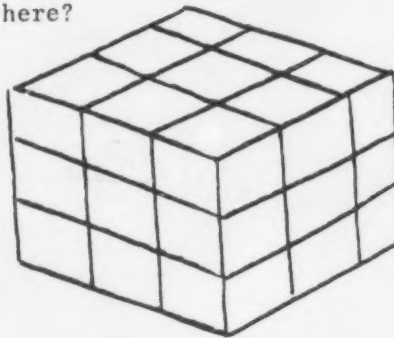
Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.



WORKSHEET

1. What is the prime objective in warehouse planning?
2. Where should fast-moving items be stored?
3. What is a short lot?
4. What is a pallet?

5. What pallet pattern is shown here?



6. Name three flammable liquids stored in the shop.

- a. _____
- b. _____
- c. _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Arrange Storage Space					
Seeing How Storage Space is Layed-Out					
Learning Proper Storage Methods					
Working With Various Storage Devices					
Learning How to Store Hazadous and Perishable Goods					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 5

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Explain How to Control Insects and Rodents

LEARNING OBJECTIVES:

1. Name the Foods Most Likely to Attract Insects

Activities:

- a. Read page 107 in Warehousing.
- b. Watch a demonstration naming the foods most likely to attract insects.
- c. Tell which foods would attract certain insects.
- d. Watch the movie: DDT in the Control of Household Insects.

Materials:

None

2. List Some Insects and Rodents Commonly Found in the Warehouse

Activities:

- a. Read pages 117 to 119 in Warehousing.
- b. Watch a demonstration listing some insects and rodents commonly found in the warehouse.
- c. List some insects commonly found in the warehouse.
- d. List some rodents commonly found in the warehouse.

Materials:

None

3. Tell How to Control Rodents

Activities:

- a. Read pages 119 to 120 in Warehousing.
- b. Watch a demonstration on how to control rodents.

- c. Discuss some safety precautions in using rat poison.
- d. Practice setting a mouse trap.
- e. Watch the movie: Ratproofing (2nd ed.).

Materials:

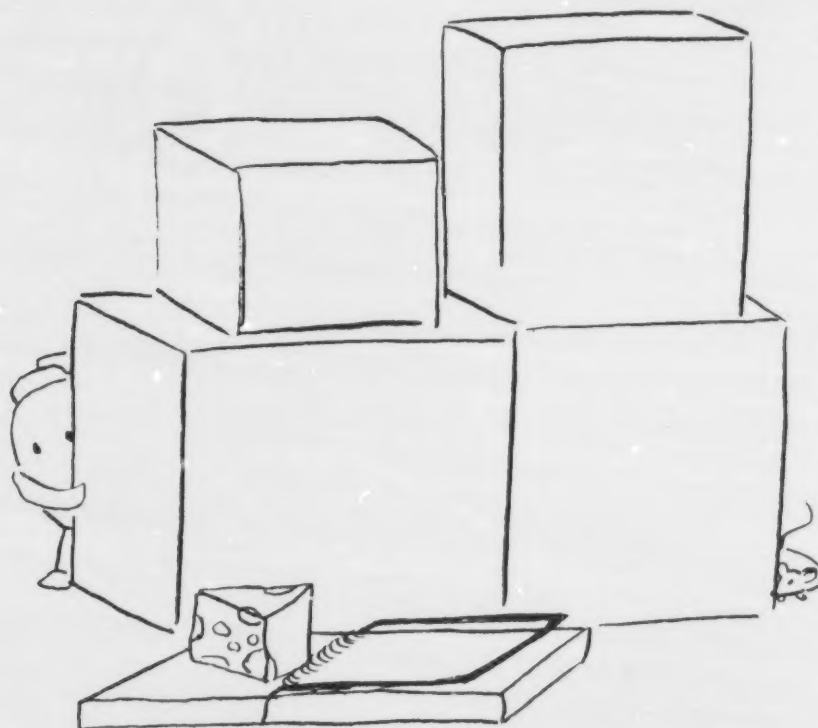
Mouse trap

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.



WORKSHEET

1. Name the four foods most likely to attract insects.

a. _____

c. _____

b. _____

d. _____

2. Describe the brown rat.

3. How do rodents usually enter a building?

4. What are two advantages of trapping?

5. When should poison be used in rodent control?

NAME _____ 843

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Control Insects and Rodents					
Knowing What Foods Attract Pests					
Identifying Common Pests in the Warehouse					
Working With Pest Control Equipment					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 6

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Tell About Stock Control Systems

LEARNING OBJECTIVES:

1. Name Four General Types of Stock Control Systems

Activities:

- a. Read page 121 in Warehousing.
- b. Watch a demonstration identifying the four types of stock control systems.
- c. Tell the advantages and disadvantages of each type of stock control systems.
- d. Watch the movie: Inventory Management.

Materials:

None

2. Tell How a Warehousewide Inventory Is Done

Activities:

- a. Read pages 122 to 123 in Warehousing.
- b. Watch a demonstration on how to do a warehousewide inventory.
- c. With your instructor's help, do an inventory of some of the supplies stored in the shop.

Materials:

None

3. Describe the Perpetual Inventory System

Activities:

- a. Read pages 123 to 124 in Warehousing.
- b. Watch a demonstration on the operation of a perpetual inventory system.
- c. Tell how this system might operate in the school shop.

Materials:

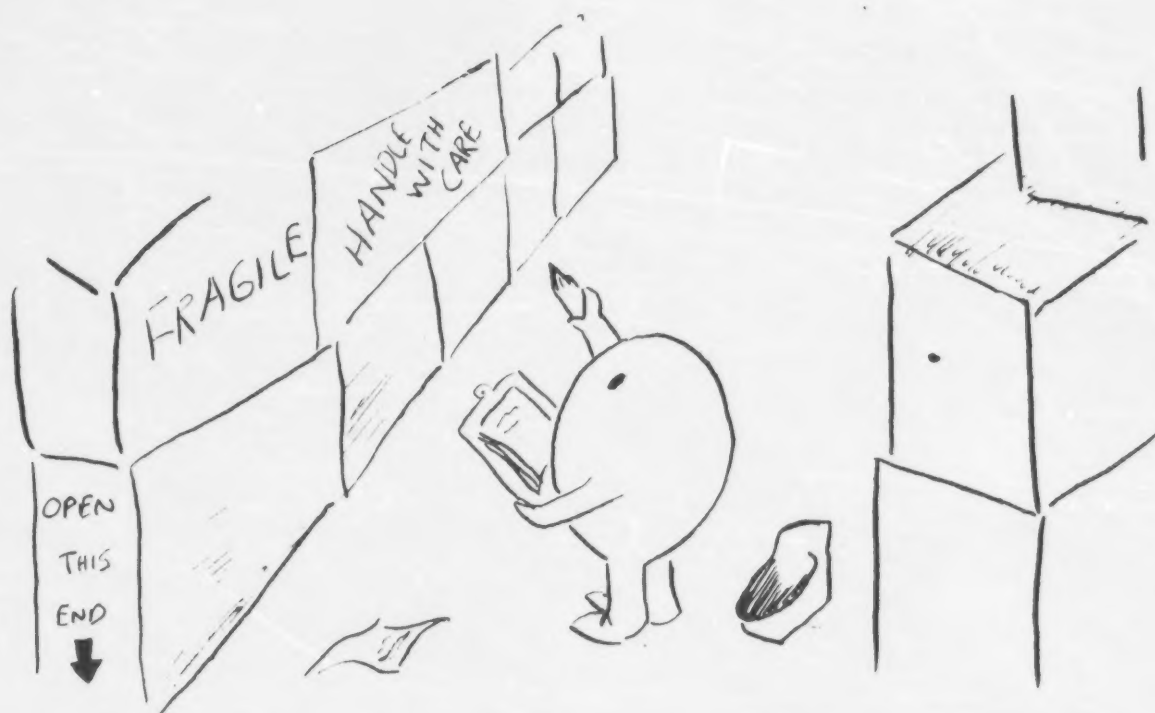
None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.



WORKSHEET

1. Name the four general types of stock control systems.

a. _____

c. _____

b. _____

d. _____

2. Which stock control system is least effective? Why?

3. What is statistical control?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About Stock Control Systems					
Finding Out About the Types of Stock Control Systems					
Learning How to Do an Inventory Survey					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 7

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Explain How to Pack and Mark Merchandise
for Shipment

LEARNING OBJECTIVES:

1. Identify the Basic Styles of Shipping Containers

Activities:

- a. Read pages 131 to 134 in Warehousing.
- b. Watch a demonstration identifying the basic styles of shipping containers.
- c. Name the common shipping containers and tell what each is used for.
- d. Tell how to build a wooden crate.

Materials:

None

2. Tell How to Pack Merchandise for Shipment

Activities:

- a. Read pages 134 to 138 in Warehousing.
- b. Watch a demonstration on how to pack merchandise for shipment.
- c. Name some common cushioning materials.
- d. Practice packing a small hand tool in an appropriate container for shipment.
- e. Watch the movie: Packed for Impact.

Materials:

Container, small tool, cushioning material, sealing material

3. Tell About Marking and Labelling Merchandise for Shipment

Activities:

- a. Read pages 138 to 140 in Warehousing.
- b. Watch a demonstration on how to mark and label merchandise for shipment.
- c. Using your practice container from Learning Objective 2, mark and label it for proper shipment.

Materials:

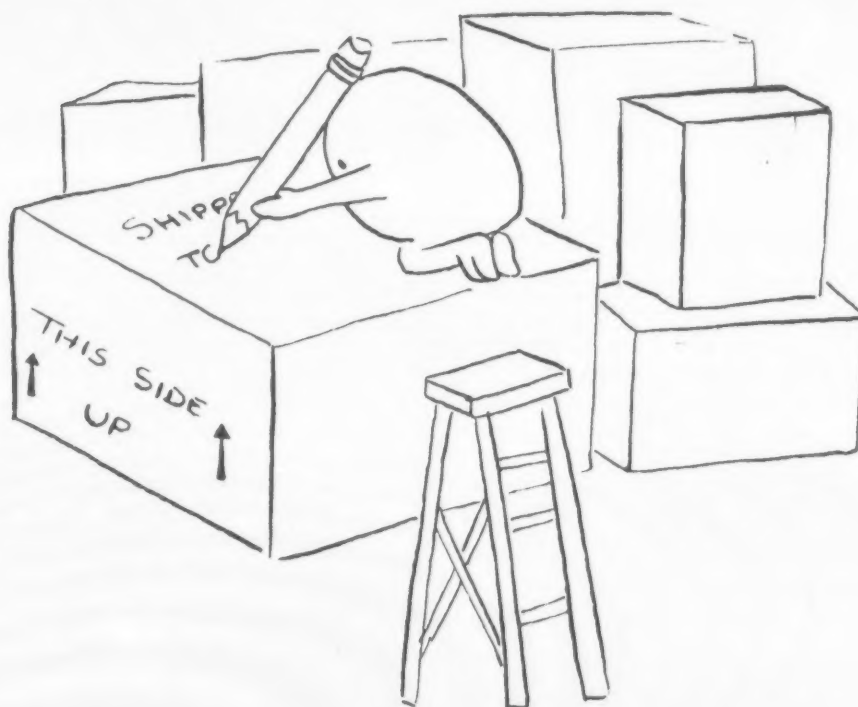
Labels, container

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.

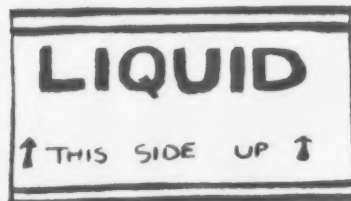


WORKSHEET

1. Define unit package.
2. Name the two fundamental principles of packing.
3. What type of shipping container is most commonly used?
4. What is the purpose of cushioning material?
5. What handling considerations should be made for:



a. _____



b. _____

STUDENT ATTITUDE SHEET

for

CLUSTER

MANUFACTURING

UNIT

WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning About the Styles of Containers Used For Shipping Goods					
Seeing How to Pack Goods For Shipment					
Packing Goods in Boxes					
Marking and Labelling Packages					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 8

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Tell How Merchandise Is Processed and Shipped

LEARNING OBJECTIVES:

1. Describe the Three Basic Methods of Order Processing

Activities:

- a. Read pages 144 to 145 in Warehousing.
- b. Watch a demonstration on the three methods of order processing.
- c. List the three methods of order processing and describe how each are used.

Materials:

None

2. Tell What Factors Should Be Considered in Selecting Stock for Shipment

Activities:

- a. Read page 147 in Warehousing.
- b. Watch a demonstration on how to select stock for shipment.
- c. Tell why the oldest merchandise must be shipped first.
- d. Get a practice order for supplies from your teacher and fill the order from the stockroom.

Materials:

Practice order, supplies

3. Discuss Considerations in Shipping Merchandise

Activities:

- a. Read pages 147 to 151 in Warehousing.
- b. Watch a demonstration on things to consider in shipping merchandise. 882

- c. Define bill of lading.
- d. Tell how to check shipments for proper order processing.
- e. Watch the movie: Materials Control.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.

WORKSHEET

1. Name the three basic methods of order processing.

a. _____

b. _____

c. _____

2. Which type of order processing is used most in small warehouse operations?

3. Give the meanings for the following abbreviations:

a. FOB _____

b. BL _____

c. CS _____

d. DZ _____

e. EA _____

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How Merchandise Is Processed					
Seeing How to Ship Goods					
Knowing How to Select Stock For Shipment					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 9

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Tell How Merchandise Is Cared for and Preserved

LEARNING OBJECTIVES:

1. Tell What Must Be Known to Provide Proper Storage of Merchandise

Activities:

- a. Read page 153 in Warehousing.
- b. Watch a demonstration on providing proper storage of merchandise.
- c. Name some merchandise that would be affected by heat or humidity.

Materials:

None

2. Suggest Storage Conditions for Selected Merchandise

Activities:

- a. Read pages 154 to 157 in Warehousing.
- b. Watch a demonstration on suggested storage conditions for selected goods.
- c. Identify proper storage for some goods.

Materials:

None

EVALUATION:

1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.

WORKSHEET

1. What is the major danger to rubber products?
2. What is the major danger to metal products?
3. What causes deterioration in paint?
4. How do paints react to freezing?
5. How can the storage life of paint be increased?

STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURING UNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Provide Proper Storage For Goods					
Identifying Storage Conditions For Some Goods					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					

LESSON 10

UNIT: Warehouse Operator

OCCUPATIONAL COMPETENCY: Outline Security and Fire Prevention Procedures

LEARNING OBJECTIVES:

1. List Some Security Precautions for the Warehouse Operator

Activities:

- a. Read page 162 in Warehousing.
- b. Watch a demonstration on security precautions for the warehouse operator.
- c. List some security precautions for the warehouse operator.

Materials:

None

2. Discuss Fire Prevention Procedures in the Warehouse

Activities:

- a. Read pages 164 to 166 in Warehousing.
- b. Watch a demonstration on fire prevention in the warehouse.
- c. Tell how to put out a certain type of fire.
- d. Watch the movie: Extinguish That Fire.

Materials:

None

EVALUATION:

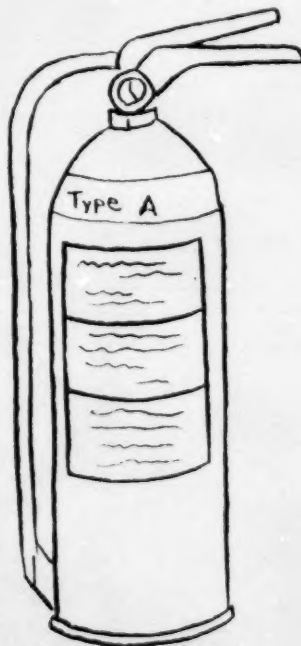
1. Complete the worksheet and submit it to your instructor for evaluation.
2. Complete the attitude sheet.

RESOURCES:

Hatchett, Melvin S. Warehousing. University of Texas, Austin, Texas, 1974.

WORKSHEET

1. What is the main objective of security, housekeeping and fire protection?
2. What is an advantage of wire barriers?
3. Why is the danger of fire greater in a warehouse than in any other business?
4. TRUE or FALSE. The following fire extinguisher is designed to put out a wood fire.



STUDENT ATTITUDE SHEET

for

CLUSTER MANUFACTURINGUNIT WAREHOUSE OPERATOR

DIRECTIONS: Please check the block which best describes your feeling toward the activities which you have just completed.

SKILLS OR ACTIVITIES					
	Enjoyed it very much	Liked it	Didn't like it or didn't dislike it	Not very interesting	Didn't enjoy any part of it
Learning How to Provide Security in the Warehouse					
Knowing Fire Prevention Procedures in the Warehouse					
QUESTIONS	YES	NO	COMMENTS:		
Are you now aware of jobs using these skills or activities?					
Would you like a job involving these skills or activities?					
Would you like to find out more about this area of work?					